FunNature: Android Application for Environmental Learning

By

Latifah Alia Binti Mohd Jamaraji

Dissertation submitted in partial
fulfilment of the requirements for the
Bachelor of Technology (Hons)
(Business Information Systems)

MAY 2012

Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

FunNature: Android Application for Environmental Learning

by

Latifah Alia Binti Mohd Jamaraji

A project dissertation submitted to the
Business Information Systems Programme
Universiti Teknologi PETRONAS
in partial fulfilment of the requirement for the
Bachelor of Technology (Hons)
(Business Information Systems)

Approved by,

_____

(Ainol Rahmah Shazi Binti Shaarani)

UNIVERSITI TEKNOLOGI PETRONAS TRONOH, PERAK
MAY 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

_____

LATIFAH ALIA BINTI MOHD JAMARAJI

ABSTRACT

The development of FunNature Android application is to provide an interactive learning aid for the preschoolers to learn about the environment that focus on flora and fauna. The objective is to demonstrate a minimum 10% improvement in object recognition through image, text and sound among the preschool children. In addition, the approach proposed by the author is mainly to assist the children during the learning process of environment by using the concept of game in an application.

The idea of this project arose from an assessment of the current method used by the Malaysia preschools which is using reading materials or Microsoft Power Point slides. The author believes that by using reading materials, it fails to grab the children's attention which later becomes a problem for the kindergarten teacher. By using FunNature application, children and teacher can enjoy the learning process together especially if they play the games together.

In order to develop such application, the author had conducted research on the following domains: (1) preschool syllabus by Ministry of Education to ensure that the game's content abide the syllabus and (2) environment domain focusing on flora and fauna in Malaysia context.

For the research methodology, this study focuses on qualitative research acquired from the feedback of children on their experience in using the existing system and their opinions on the new interactive application. Parents and teachers also cooperated to give their feedback on the prototype of this application. Using a Rapid Application Development model, the author successfully developed an application that is user friendly and cost effective using Android platform. The final prototype of FunNature Android application is developed using Adobe Flash Creative Suite 5.5.

ACKNOWLEDGEMENT

First of all, the highest gratitude to Allah S.W.T the Almighty for the gift of health, strength and ability for me to complete the Final Year Project I and II within the allocated time period. I would like to express my appreciation towards Ms Ainol Rahmah Shazi Binti Shaarani, the dedicated Final Year Project supervisor for assisting and providing guidelines throughout the project development. The knowledge and experience shared by her is very valuable and without it, the process of completing this project would not have been easy.

In order to complete this project the author had conducted survey, interviews and system testing with a representative preschool at Bandar Seri Iskandar. Therefore, an utmost appreciation is given to Madam Azreena Alwi, Miss Nadia and Miss Shikin from Tadika Pintar Anak Soleh (PASTI) for their cooperation during the information gathering and product development stages.

In addition, deepest thanks go to my parents and family members for their constant support regardless of my condition and situation. Last but not least, I would like to thank everybody involved in completing this project directly and indirectly.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND NOMENCLATURES

MOE: Ministry of Education
RAD: Rapid Application Development
UAT : User Acceptance Testing

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The title for this project is FunNature Android Application, an application that incorporates the game features into it for the children to learn about the environment especially flora and fauna. Therefore, the focus of this project is to do research on the related disciplines in order to make sure that the final outcome is aligned with the needs and requirements as well as to develop Android application named FunNature. The main areas that were being investigated for this research are:

1.1.1 Environmental education using Mobile Application

According to Ma & Bateson (1999), responds from the students varies based on their age. Different positive attitudes toward the environment were expressed by different grades. In addition, preschool children tend to give more positive attitude to the environment compared to the older students. However, they also easily respond to any problems negatively. This is also supported by NAEE (2010) saying that children should not be burden with environmental problems but instead, educate them about the various components of environment. Children do not have enough coping skills to understand the real issues of the environment and they will associate environment with a negative element.

In a paper presented by Uzunboylu et al (2009), mobile learning can be used to increase the environmental awareness of the university students. Information and pictures exchange occurs between classmates and this helps to create positive attitudes towards the environment. For example, a student is

watching an animal that has never been seen before and he uses the camera to take pictures of it and transmit it to his friend in real time. The finding is that the environmental awareness of males and females students increased significantly and attitudes toward maintaining clean environments and preventing pollution improved.

1.1.2 Android technology

The second discipline that was covered in this project is the Android technology, specifically in the area of application development. FunNature is developed on the Adobe Flash CS 5.5 platform, which is a simpler and interactive way to develop an Android application.

1.2 Problem Statement

1.2.1 Reading materials is not interactive and convenient

According to the preschool curriculum approved by the Ministry of Education, there are several modules to learn about environment. Therefore it is compulsory for every kindergarten in Malaysia to teach the children about it. However, the current methods used by majority of the kindergarten are reading materials such as notes and books as well as Microsoft PowerPoint slides. In this study, the children feel that these available resources are not convenient. For example, during field study to examine the nature, the students need to refer to the printed resources while being transported to the destination and listening to the explanation from the teachers, which results in an inconvenient way of learning.

Besides that, reading materials is not interactive. This does not contribute to an enjoyable learning process for the children. By using FunNature, children can learn about the nature by playing the 3 different games. The details about the games are discussed further in Chapter 4.

Because the current method is not interactive, it is hard for the preschool teachers to grab the children's attention during the learning process. The proposed application allows any user to play 3 different games on guessing the name or habitat of the displayed animal or plant as well as matching the sound or voice to the correct animal. Besides that, children can also read the descriptions of various flora and fauna, focusing on Malaysia context.

1.2.2 Learning with parents

The number of Android users is increasing nowadays and it is not wrong to say that this is the current trend in the smart phone and tablet market. Children are often seen playing with their parent's gadget and most of the time they will use it to play games. In educating the children, parents can now use mobile app as a learning medium to teach their kids about any subject domain. The learning process should be informal to let their children enjoy learning about the nature. Parents now can spend more time with their children by playing the games together and indirectly explain to them about any particular flora or fauna.

1.3 Significance of study

The significance of FunNature that distinguishes it from the available Android app for environment education for preschool children lies at its features. The proposed app combines two main components in the environment which is flora and fauna. In the research done by the author, there is no existing app that has these 2 main groups together. Besides that, there is less Android application available to learn about plants or flowers. Each main group are further divided into several subgroups. For flora, there are three different subgroups which are plant, fruit and flower and for fauna, 2 subgroups of animal and underwater animal are created.

In addition, the game will ask the user to match the habitat or origin of each flora or fauna to symbolize the important of nature conservation. Another game module is using animal's sound for the children to identify the 'missing' animal.

Lastly, another distinguished feature of FunNature is that the content will focus more on Malaysia context. This allows the children to learn about flora and fauna that is available in Malaysia. Currently there is no existing environmental education based application that focused on Malaysia context.

1.4 Objectives

The project has four main objectives to be achieved by the end of research and development period:

- To develop an Android application (FunNature) to facilitate and assist the preschool children in learning about environment domain.
- To study on the theory and development of mobile application.
- To research on the preschool syllabus in Malaysia.
- To demonstrate a 10% minimum improvement in animal and plant recognition after using the application.

1.5 Scope of study

The study is focusing on developing a mobile application that can facilitate children in learning about the nature as well as to instil the environmental awareness. Since the study is targeting the children, the first task of this project is to research on the preschool syllabus prepared by the Ministry of Education. The application content will follow the guidelines of the syllabus to ensure that the level of information is appropriate.

The study also includes the environment domain focusing on flora and fauna. As explained earlier, the proposed application will focus on Malaysia context to make it different from the rest of the applications available in the Google Play Store. Therefore, a research on the list of animals and plants in tropical rainforest is needed to be use as the content. It is also very crucial for this study to cover on the various mobile markets available currently. Through the study, the author can determine the major players for this industry and identify the most suitable platform to develop this project.

1.5 Relevancy of Study

The implementation of this application is relevant to the children because it can assist them during class or field trip. Interactive learning medium is needed to ensure that the children focus is towards the learning subject and this application helps the teacher to achieve an enjoyable learning process.

Besides that, children can play the games as an alternative to learn about the nature. Enough description together with correct pronunciation and animal's sound will definitely make the learning process easier for the children.

1.6 Feasibility

The designed mobile application will be completed according to the budgeted time frame given. The author is given two semesters to do research and to develop the application. During the first semester, the allocated time focuses mainly on planning and research process. In the first part of Final Year Project, the author's effort is more towards research and writing the report. The author also needs to study on analysis and user requirements for the application to ensure that the designated scope is feasible to the users.

In the second semester, the author will focus on the development and implementation of the mobile application. This project is feasible and can be completed within the allocated time period as there are no problems in obtaining legit information to develop the FunNature.

CHAPTER 2

LITERATURE REVIEW

2.1 Children Learning

Learning is not only exclusive to the education system, but it happens a long time before school, continues even longer and grow rapidly during school (Pritchard, 2009). For example, it starts when a baby learns how to crawl and walk, toddler learns how to talk and the process goes on. Learning is divided into many approaches but the main purpose is to develop new knowledge and skill to groom the person to be better.

Early childhood is one of the early phases in a life cycle. Children ages two to six years old are categorized into this group. According to Berk (2006), there are two types of children development; physical and psychological. It is easy to detect and monitor the physical development of a child as it can be seen externally. Their body will become leaner and longer and be more self-sufficient and able to control themselves. These changes usually happen naturally. On the other hand, psychological development results from the children daily activities and play. The language and thought grows quickly thus they start to have more conversation and develop relationship with others.

Early childhood is the period where children undergo rapid growth in every aspect. They are able to learn from the surrounding environment such as family, teachers, preschool friends and other objects. Thus we can label the children as a natural learner (Holt, 1995). It is easy for them to acquire any new information and knowledge because they are still pure and innocent.

According to Piaget theory, there are four stage of development which consists of sensory-motor, pre-operational, concrete and formal operational. Focusing on the group of 2-7 years old children, the pre-operational stage is where the children are able to represent ideas and mental imagery through learning medium. In addition, the use of symbolic thought and imagination develops at this stage (Pritchard, 2009).

One may learn in a different way from others which maybe depends on their learning style. Every child has a particular learning personality which is distinctively different from one another. According to Pritchard (2009), they start to learn by using all their five senses but later, they will be comfortable to a particular learning style based on how they communicate. Some children may learn well when they see things (Visualization Style), some may like to learn through listen and speak (Auditory Style) and others may like to learn by performing some actions (Kinaesthetic Style).

Regardless of what learning style the children have, the common nature among all children is that they like to play because play is a natural part of the children behaviour. It has been described in many cultures and in many periods of history, which shows that play is a universally accepted as a part of learning process (Saracho, 2003). According to Verinikina (2003), the young children educators must know the importance of playing in the children's daily activities. It is not only a spontaneous or enjoyable activity but actually it also help in the process of children's psychological development. Children will start to play when they want to and have their own rule in playing.

In *All Work No Play*, the author describe his experiences involving in the kindergarten for more than 30 years that "the children who were the most active players in the preschool were also the most active learners in elementary school", Olfman (2003). The attention span of children varies with age, gender and type of activities they participate. In general, children's attention span develops two minutes per year as children grow. Thus 3-year-old children will have at least six minutes attention for any activities they participate. However they will be able to maintain a longer attention and concentration on the activities that match their interests.

2.2 Children and Nature

Incorporating nature into the early childhood is important as it is best to nurture them with environmental awareness from early age. We may think children will be engaged with the environment by learning the importance of nature conservation such as recycling or using green products. However, according to Erickson (2008), the children are best to be nurture with love and appreciation towards nature since they are young. There is less need for formal education but parents can involve the children with activities that will indirectly teach about environment. As a result, this will contribute to the child's development and to the environment as well.

There are differences between environment educations for adults with early childhood environment education. NAEE (2010) explained that the early childhood environmental education focuses on conservation concepts to build a positive understanding towards the nature and anything negative issues such as endangered species or environmental degradation should be avoided. Children will respond with sadness or fear because they do not have the coping skills to face such tragedies. The children should not be put burden on environmental issues and if they do, they will associate environment with something negative, which is not good for their development.

The best time for the children to learn is when the activities they do excites their curiosity. Davis (n.d.) feels that although there is little common platform between early childhood and environment education, both fields actually need each other and considered as 'natural allies'. In addition, he also agreed that environmental issues such as ozone layer and its affect towards human body are not suitable in the early childhood view of environment. Similarly, long term issue such as strategies to conserve the environment is also not suitable for children's learning. What should be included in the early childhood environment education are the key concepts that give immediate understanding towards the environmental issues such as biodiversity The educational sectors especially the teachers should put more emphasize on how to make the children love the nature, instead of putting burden on them to think of the bigger environment issues.

In most education system, environment is taught through outdoor activities such as planting or recycling. In Denmark, the implementation of nature learning with the school activities helps the children to understand the relationship between human and nature as well as build practical skills. Formal education at school or informal learning through family activities can help children to gain knowledge about nature and build interest. To get children closer to the nature, they must engage in positive and active experiences in nature. As a result, the experiences indirectly contribute to raise environmental awareness in addition to other factors (Fuks, 2004).

It is publicly known that children are better information receiver than adults because they can learn new words at a better rate and the level of eagerness to learn about something can be visually seen. Children also are not afraid to comment about something if it is wrong. Thus, the approach to educate children need to be different from those for adults (Tilden, 1977). In addition, he argues that abstract information is not suitable for children as they tend to see things individually. Thus, explanation is needed on critical concept. The example given by Tilden is 'ecology' which is a complex word for children. To make it understandable, 'ecology' need to be define as a life chain that consists of trees, insects, animals and flora in their habitat. In this way, it is easier for the children to get the idea of 'ecology' by using living things in the nature.

Hinds and Sparks argues that respond to nature differs based on children location. Children who live in rural areas are more likely to respond positively to nature compared to the urban peers. They also find that activities preferences differ between both groups. Rural children tend to do activities such as camping or caring for animal while urban children are less likely to involve in similar activities (2007).

2.3 Learning through Games

In this digital age, computer is a part of our life by assisting us to perform daily routine. This machine currently has also invaded the children life as they started to play with computer at a very young age. Although there are many arguments when children spend too much time with computer or television, most parents enjoy seeing their children exploring the technology because they can learn and play at the same time (Verenikina, 2008). However, parents need to monitor the children so that they will not spend excessive time with technology.

Software providers are targeting children because although the parents pay for the games, but the children are the main user. Currently, the number of educational software or game has increase substantially especially for this target group. In order to attract the children interest, the educational game is developed with a playful and interactive manner (Verenikina, 2006). Although the main objective is to educate the children with a specific subject matters, but the game need to remain attractive for it to be successful in delivering the knowledge because it help to keep the children's focus and interest.

Preschool children usually already know how to play games and to them, games are meant to be together with friends. Children always take part voluntarily when playing game because it is less structured and fun (Vangsnes et. al, 2011). They also viewed that games is some sort of competition, because player need to solve problem and gain points to proceed to the next level. This characteristic helps to develop the children's mind on how to survive in the game.

Educational games are also considered as a medium of learning and preschool teachers are adopting this activity into the children's curriculum for a better academic syllabus. The pedagogical games can be used to teach many subject matters such as language, number or science. Often the teacher will take part in the playing activity to assist the children but the teacher's role should not be too controlling until it limits the freedom of playing. The educational games will limit the teacher's involvement in the activity but it builds the children mental and physical interactions (Vangsnes et. al, 2011).

2.5 Malaysia 2010 National Standard Curriculum for Preschool

The FunNature Android application is developed with four different modules concerning on the names and habitat of flora & fauna as well as identifying animals using sound. Apart from following the guidelines of preschool syllabus approved by the Minister of Education, the modules are created because of the importance of knowing such content by the children.

Based on the research done by the author, the syllabus currently used by all preschools in Malaysia was last updated in 2010 by the Ministry of Education. The responsible party to draft and approve the curriculum is the Curriculum Development Division, MOE. In the curriculum, the study of environment is grouped under Science and Technology core, Section 3.0 ST. The section is further into 4 subsections but only 3 subsections are related to this project as illustrated below:

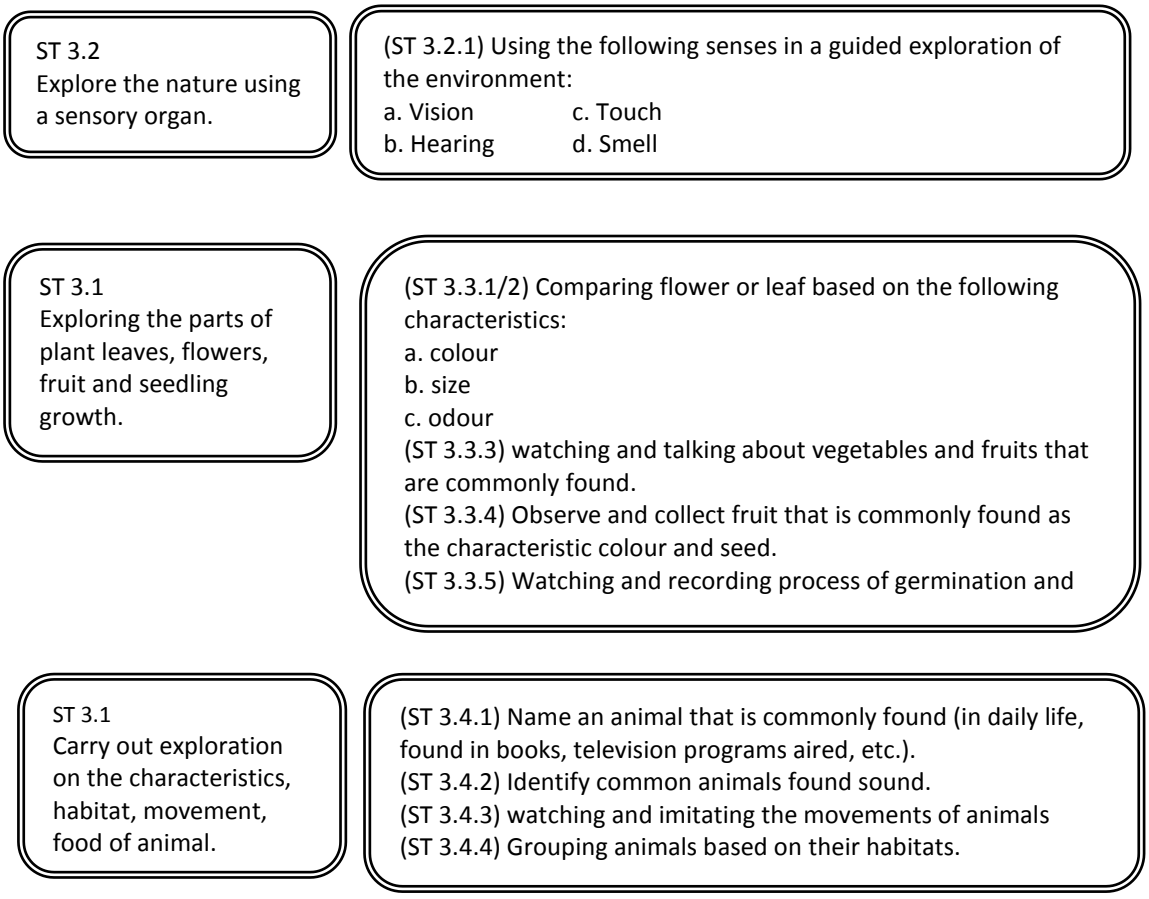


Figure 1: Social & Technology core, Environment Section (MOE, 2010)

According to MOE (2010), the standard curriculum emphasize on the exploration conducted on the nature of life mainly (1) plants and animals, (2) natural materials such as submerged objects or water and (3) material such as rainbow or weather. The Social & Technology core emphasizes the children skill of knowledge acquisition. In order to achieve the learning objectives, teachers need to be open to the children's view and exploration results.

The curriculum is used by the author as a preliminary standard for this project content. This is to ensure that the FunNature Android application content is suitable to the preschool children aged from 4 to 6 years old. Apart from attending classes, children also can use FunNature to learn about the environment. However, for this project the author had to limit the content into identifying the names, sound, and habitat only. This is to develop the children's ability to differentiate various flora and fauna.

2.5 Existing System

There are various education-based Android application but the features are different from what the author trying to implement in the proposed application. There are also websites that has similar agenda with the proposed FunNature Android application. Below is the example of existing system that focuses on giving information about the flora and fauna.

2.5.1 Website

An example of website available for everyone to learn more about the flora and fauna is the Flora & Fauna International (FFI). FFI was the world's first international conservation organization with background history over a century ago. Users particularly ecotourists can view the various species listed in the website as illustrated by the Figure 2. The website provides the Latin name, origin and family kingdom. However, this website is not practical for preschool usage because the level of language is extensive and requires deeper understanding towards the nature.

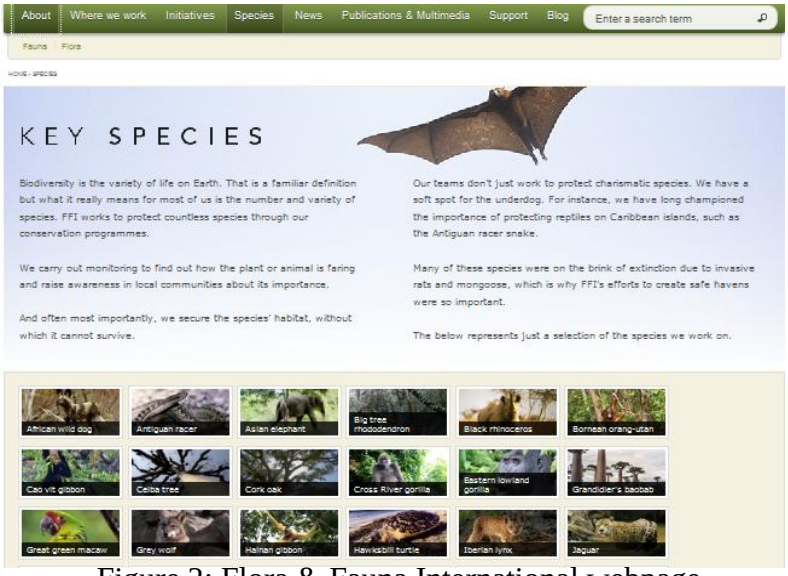


Figure 2: Flora & Fauna International webpage

(Source: Flora & Fauna International)

Another example of website is EEK! (Environmental Education for Kids). The website provides extensive information on animals and tips on how to help save the mother earth. The animals' descriptions are classified into different groups such as mammal, amphibian, reptiles and invertebrates. However, there is no information on plant, fruit or flower although it is another major part of environment.

Figure 3: EEK! Webpage (Source: EEK!, 2012)

2.5.2 Games

Computer games are the indirect competitors for the proposed Android application because it may offer similar contents, but the technology and approach is different from the android app. Various environmental games are available and it can be access on free online games website. For example, in EcoKids website, several games are available as illustrated in the Figure 4.

Figure 4: Environmental Games (Source: EcoKids, 2012)

2.5.3 Android Application

By performing a simple search at the Google PlayStore, you can get results on various educational based games, including environmental games. The Figure 5 shows an application named ‘Kids Animal’ that contains questions and descriptions for more than 70 animals. It is divided into four different stages such as Farm and Domestic, Forest Wildlife, Africa Wildlife, and North and South Pole. The game also has voiceover and animal sound to help the children understand better about animals. However, this Android application need to be purchase and the free version has limited access into the game.

Figure 5: Kids Animal (Source: Play Store, 2012)

In comparison to another application named 'Kids Finger Touch', this application is aimed for toddler to preschool children. The content is animal picture cards and picture matching quiz. There is no sound or voice that can facilitate the children especially on how to pronounce the word or how the animal sounded. This application is relatively easy and fuss free.

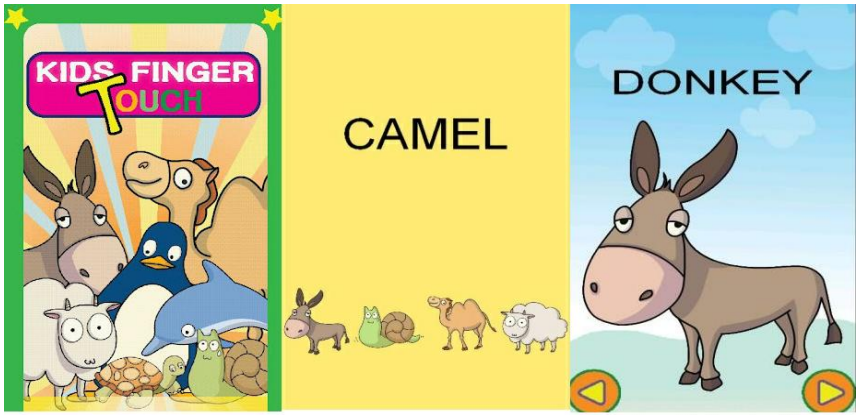


Figure 6: Kids Finger Touch (Source: Play Store, 2012)

Referring to Figure 7, a combination of fruits, animals, vehicles and birds is applied in the 'Kids Combo Mega' application. It applies the function of a flash cards or board books. The children can go through all items and recognize them by name and voiceover. The disadvantage is that it lack of interactivity as the user can only learn the names.

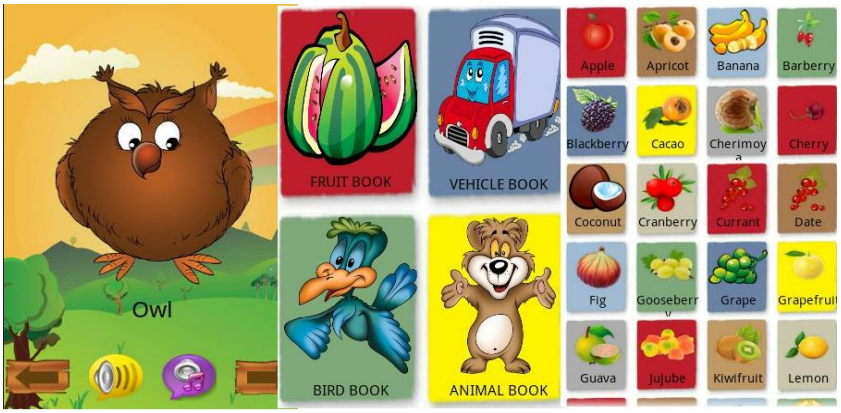


Figure 7: Kids Combo Mega (Source: Play Store, 2012)

2.5.4 Existing Method Used in Tadika Pintas Anak Soleh

The author went to investigate what is the current method used by preschool to teach the environmental subject. Tadika Pintas Anak Soleh was used as the subject for this project. Currently the preschool is using a simple powerpoint slides and notes materials to teach the children about environment focusing on animals and plants.

2.5.5 FunNature Android Application for Learning Environment

The proposed Android application named as 'FunNature' is aimed to assist any children aged 4-6 years old in learning about environment as explained under section 1.0. For this project, the subject is limited to flora and fauna only. r 5

2.6 Overview on Mobile Application

Software program running on the handheld devices such as personal digital assistant or mobile phone is called mobile application. It can be installed by the manufacturing company or downloaded by the users from the various platforms such as Android market or App Stores. According to a report by mobiThinking (2011), there are two types of applications available in the market now. The first type is the native application which is installed on the device and developed specifically for one type of mobile phones in order to maximize the phone's functionalities.

On the other hand, mobiThinking (2011) also justified that the second type of application is accessed through the Internet, located on a server and known as the Web application. It performs specified task written for the program, which is similar to the native apps. However, the application will be downloaded to the device each time the user wants to use it and it requires internet connection to use the application.

With the emergence of smart phones and tablets, it has changed the way users connect to the Internet. In Figure 8, Newark-French (2011) compares the average number of minutes spends per day on mobile native application against the time consumer spend on the website. More time is spent by the users on the mobile application compare to Internet and it is higher than 9 percent. The changes are significantly drastic because in June 2010, average users spent only 43 minutes per day using the mobile application and the number almost doubled on June 2011.

On the other hand, the time spent on the Internet has grown at a slower rate of 16% compared to the growth rate of mobile application which is 88%. Newark-French (2011) argued that the drastic change on the usage of mobile application is caused mainly by more sessions made by each user per day and not because of the longer average time spends for each session.

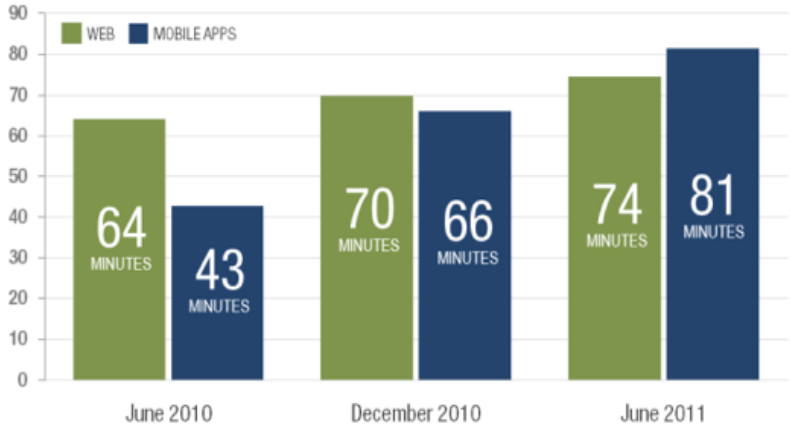


Figure 8: U.S. Mobile Apps vs. Web Consumption, Minutes per Day (Source:Newark-French)

2.8 Mobile Phone Market Share

According to a report by BBC News, Apple is now the world's biggest seller of smart phones and taking over Nokia and Samsung in the second quarter of 2011. Referring to Figure 4, even though Apple is the top listed in the best seller of smart phones, its share market is only 6% placing it the world's fourth biggest mobile phone seller behind Nokia, Samsung and LG. In contradictory, the biggest seller is Nokia with all types of handsets sold in the second quarter amounting to 88.5 million. However, its market share dropped to below 25% making the statistic the lowest achievement for Nokia since 1999 (BBC, 2011).

Taking over number three is the Korean company Samsung with total of 74 million units of mobile phones shipped to all over the world. In terms of smart phone ranking, Samsung are catching up Nokia with a mere difference of 4% as illustrated in the Figure 9. Another Korean company listed in the top five brands is LG, with a total of 24.8 million units of mobile phone shipped to other countries. Lastly is ZTE, which is a China based company with a shipment over 18 million units. Both LG and ZTE are not producing any smart phones currently.

	All handsets	Smartphones	Total market share
Nokia	88.5m	16.7m	24.5%
Samsung	74m	19.2m	20.5%
LG	24.8m	n/a	6.9%
Apple	20.3m	20.3m	5.6%
ZTE	18m	n/a	5%

Figure 9: Mobile Phone Shipments [April – June 2011] (BBC, 2011)

In Figure 10, the graph shows the operating system (OS) market share from Q1 2011 untill Q1 2012. The top four mobile operating software (OS) in the world from first quarter of 2011 until first quarter of 2012 are Android OS,iOS, Windows Phone 7 and Blackberry RIM. The OS share of Android rose from 49% at the Q4 of 2011 to 61% at Q1 of 2012 while at the same time its strongest competitor, iOS dropped its share from 41% to 29%. Based on the market share, it can be conclude that Android OS will be holding more market share in future and this will guarantee more target users for the proposed application.

With 51.9 million of Android phones shipped in the second quarter of 2010, Android was listed as the top mobile OS in 35 countries (Reed, 2011). Android OS share market is expected to grow bigger with the OS runs on devices from multiple vendors such as HTC and Samsung.

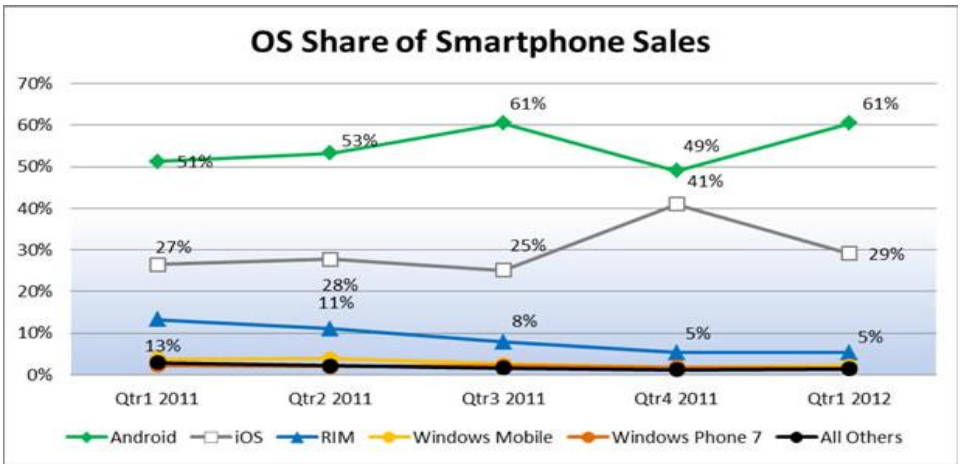


Figure 10: Operating System Share Market (CNet, 2012)

2.9 Overview on Android

Android was launched in 2007 by Google as a free software platform. It is an open standard for any mobile devices based on Linux OS.There are several mobile application development platforms available such as Java ME, Flash Lite and Android. The comparison between the platforms is illustrated in the Table 1.

Platform	Java Micro Edition	Flash Lite	Android
Development Language	Java	ActionScript	Java
Application Framework	Optional package, Media API,Location API, Graphic API	ActionScript API	-Window/Telephony/ Location..Manager (Android SDK) -Core Java libraries
Runtime	Kernel based virtual machine	Flash Lite player runtime	Dalvik virtual machine
Operating System	Symbian OS, Palm OS, Blackberry OS	Symbian OS,Windows Mobile	Linux Kernel

Table 1: Comparison between mobile application development (Source: Appiction)

Android is the best platform to be used in the development of this study because Google provides an open source software development kit for OS. Android provides a better environment because it has device emulator and debugging tool which allows the author to test on Android simulator before loading the application onto an actual Android phone. With Android's open source nature, developers are given more freedom compared to iPhone which has restricted capability to do major changes to the operating system (Appiction, n.d.). Because of its open source nature, all source codes are transparent and any Android developer can modify the original source codes.

CHAPTER 3

METHODOLOGY

3.1 Rapid Application Development

In this study, the author chose to implement the Rapid Application Development model. This model is chosen because of the limited time frame for this application to be completed, which is approximately 8months.

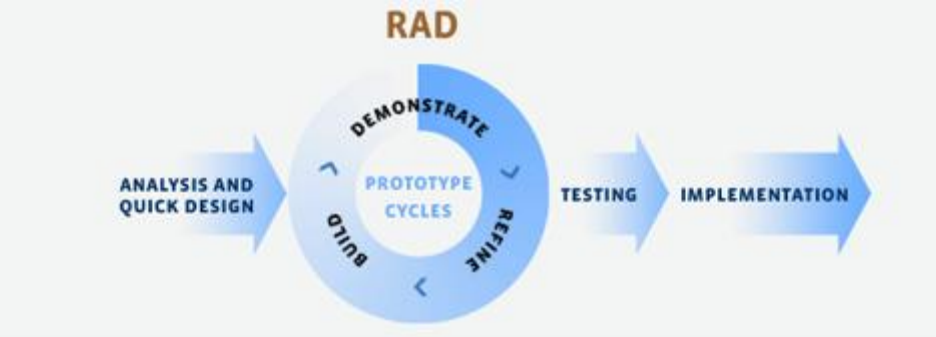


Figure 11: Rapid Application Development Model (Source: EtonDigital)

This lifecycle has four stages that include all of the activities and tasks required to scope and define the system requirements and design, develop, and implement the application system that supports those requirements.

3.1.1 Analysis & Quick Design

1.1 Planning phase

There are some steps that need to be done during the planning phase. This stage is crucial so that the development of the project can be carried out within the time constraint and to deliver a usable system to the end user. The steps for the planning phase are described as below:

- Firstly, the topic needs to be redefined. The problem statements, objectives, scope of the system and existing research paper regarding this study are identified and documented.
- Identified the desired tools for this study.
- A project schedule is implemented in order to outline the necessary tasks and process. The prepared Gantt chart is attached in Figure 12.
- The methodologies for data gathering are planned, which is using questionnaires and interview method.
- The data collected from the methodologies will be analyzed.

1.2 Data Gathering

The main method for data gathering for this study is through research, survey and interview. The survey is done through researching the available existing mobile applications and the major key players in the mobile market. There are various android app that were created to learn about animals. Most of the data gained is discussed in Chapter 2 Literature Review.

In addition, the author already conducts an interview with the Tadika Pintas Anak Soleh, Bandar Universiti to get their respond on this study. Miss Nadia, the teacher from the preschool was interviewed on 29 June 2012. Since the mobile application is targeting the preschool children, therefore the feedback from their teachers is important for this study. Besides that, by gathering the data through interview, it will be easier for the author to recognize and discuss the functionalities of the proposed game. Further details on the interview will be discussed under Chapter 4 Result & Discussion.

The author also has conducted survey on 29 June 2012. As many as 45 survey forms have been distributed to the parents to gain their respond and suggestion on the proposed game. The result on the pre-market survey is discussed under Chapter 4. The questionnaire is attached at the Appendix A.

1.3 Storyboarding

The design method used in the quick design phase is storyboarding. This method help determine which functions will be useful, how it should be presented, which tools to be used and the information needed for this study. For this study, the storyboarding is visualized through drawings of how the actual prototype will be functioning. By preparing the storyboard, the author and users are able to understand the expected behaviour of the system and its capabilities. The storyboard will also be able to show the actions users can perform and the requests that the user can make. As a result, it will help the author to see the most important parts and make changes to the system requirements if needed. Lastly, by preparing storyboard it will help the author to start the initial development for the application.

3.1.2 Prototype Cycles

Also known as the Functional Design Stage, this stage is to build a working prototype that consist only the critical components of the application. In order to create such prototype, the author needs to install Adobe Flash CS 5.5 and Adobe AIR. The reason why the author chose Android as the mobile application development platform has been discussed in section 2.8. The project will be developed using a personal computer that has several specifications in terms of its hardware and software. Once the author has completed the development process, the application will be transfer to an Android phone. Table 2 below define the specifications in developing this project.

Tools	Specification
Operating System	Microsoft Vista Home Edition
Memory	2 GB RAM
Peripheral	Printer, scanner, keyboard, mouse, monitor
Development platform	Android
Software development	Adobe Flash CS 5.5

Table 2: Specifications of hardware and software

3.1.3 Testing

When the first prototype is completed, it will be test whether it meet the requirements listed during the planning phase. The system testing with the teachers had been conducted on 30 July 2012 and the findings are discussed further in Chapter 4. The functionalities of the application will be tested before proceeding to the implementation phase. The user testing was conducted on 11 August 2012 with 18 students as the respondents. During the testing session, the children were asked to answer several questions before and after using the FunNature to measure the improvement in children ability to recognize flora and fauna.

3.1.4 Implementation

Also known as the deployment stage, this stage includes final user testing and training and the implementation of the application system. After the UAT, the Android application will be available at Google Play Store for users to download.

3.2 Project Activities

3.2.1 Project Gantt chart

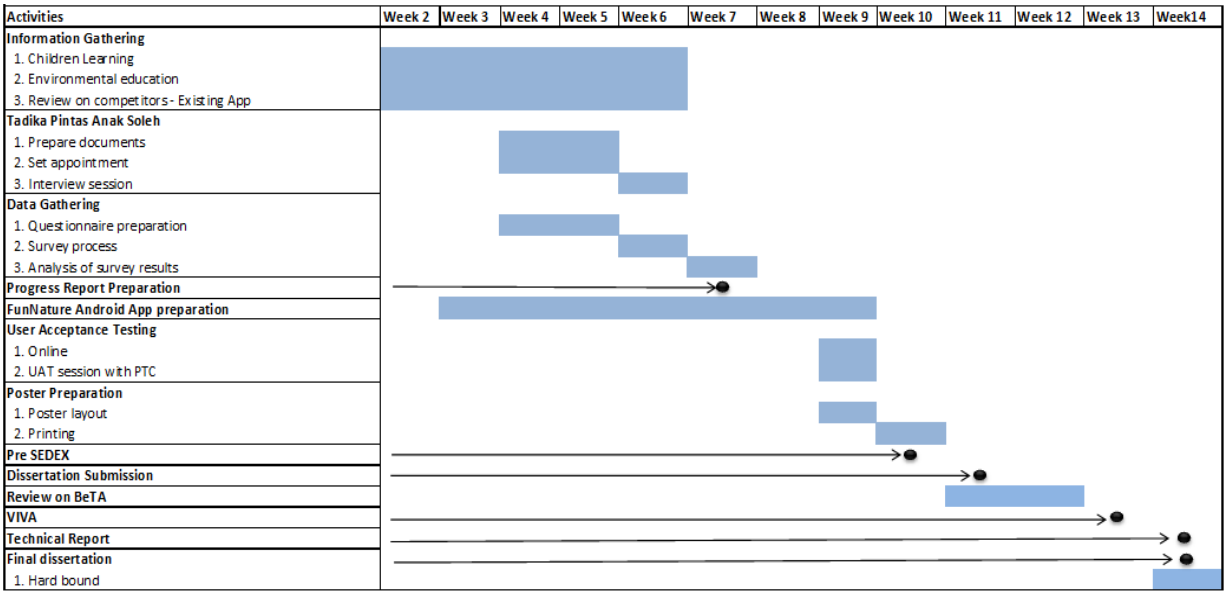


Figure 12: Project Gantt chart (FYP II)

3.2.2 Prioritized List of Requirements using the MoSCow approach

M – MUST	- Read description on flora and fauna - Play 'Guess game' that guess the name of the displayed animal or plant - Play 'Guess game' that guess the habitat of the said flora or fauna - Play matching voice/sound with animal
S – SHOULD	- Have background sound and voice
C – COULD	- Gain points
W – WONT	- Description in other language

Table 3: Prioritized list of requirements using MoSCow approach

According to Clegg (2004) MosCoW theory, the author listed the requirements for the project based on priorities using the MoSCow approach. In this approach, the requirements are divided into four different levels. The first level is the must have requirements which is essential in order to create the mobile application. The author has finalized the design for the Android application and the games are the main part of the application. With the application, children can read descriptions about animals or plants, play matching game and also play 'Guessing game' on the name and habitat of the displayed animal or plant.

The game 'Should' have background sound to make it more interesting. The author has decided to insert different background sound to be play when the user clicks the correct or wrong answer. Requirements labelled as 'Could' is less critical. It suggested that the game can track the points for each successful stage and the player can view the highest mark based on previous game. However, due to time limitation, the author decided not to include the said feature.

Lastly is the 'Wont' requirement that is the least critical component and it is not included in the delivery schedule timeline. For the future, the author proposes that this game should be developed for other language such as Mandarin or Tamil. This can attract more children to use the FunNature application besides giving them more opportunity to learn the words and terms in other languages.

3.2.3 System Framework

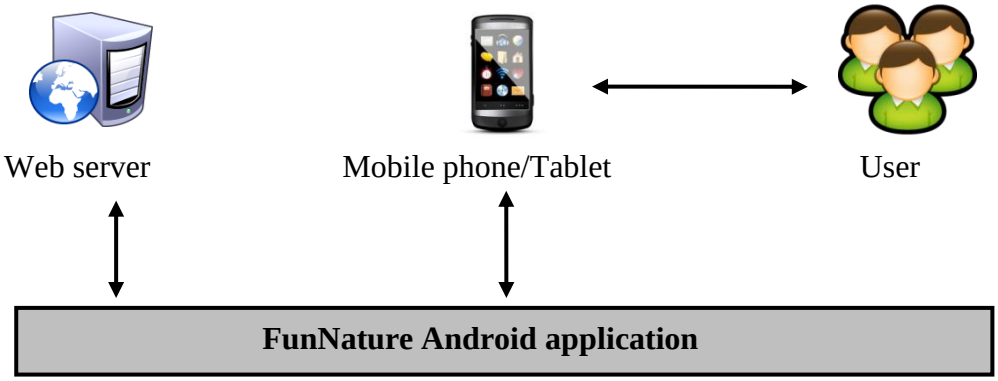


Figure 13: System Framework

The system framework of the FunNature Android application is made up of four components; web server, mobile application, mobile device and the end users. The architecture for this project is simple because the application will only run locally on the device with no communication against other systems. This type of Android application is called as native application.

The backbone of the system is located on the web server. The application will be load onto the web server using mobile application websites such as Play Store and the users can download the app from the website. However, the minimum Android firmware that is compatible with this application is 2.1 and above. Once the user has downloaded the application, he or she needs to install the application on the mobile phones. In this study the author limit the application platform to Android based on the justification made in section 2.6 until 2.8.

3.2.4 Use Case Diagram

The use case diagrams illustrate a unit of functionality in the system and shows how the different parts of the system interact with each other. There are 4 activities that the player can perform with the game as shown below.

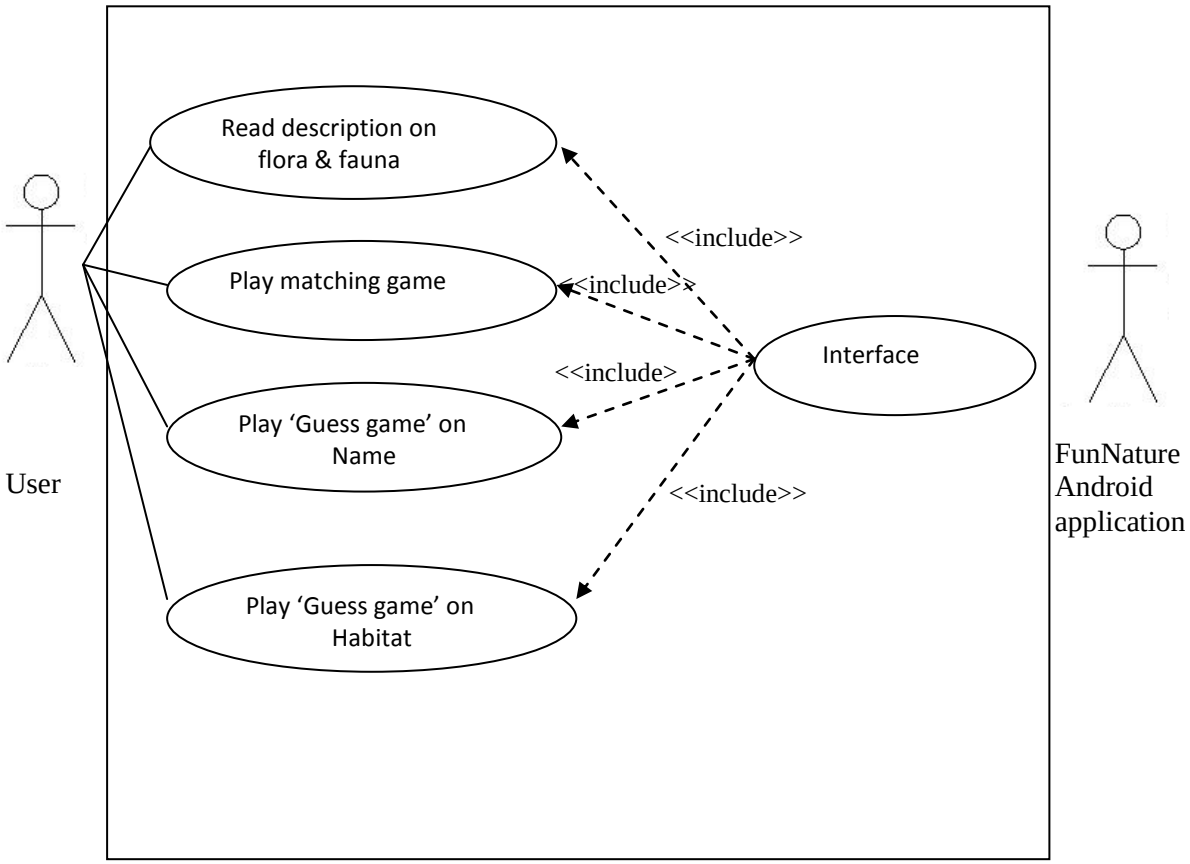


Figure 14: Use Case Diagram

3.2.5 Activity Diagram

The activity diagram illustrates the different activities in the FunNature Android application. The flow of the system is given and this illustrates what are the options available for the user.

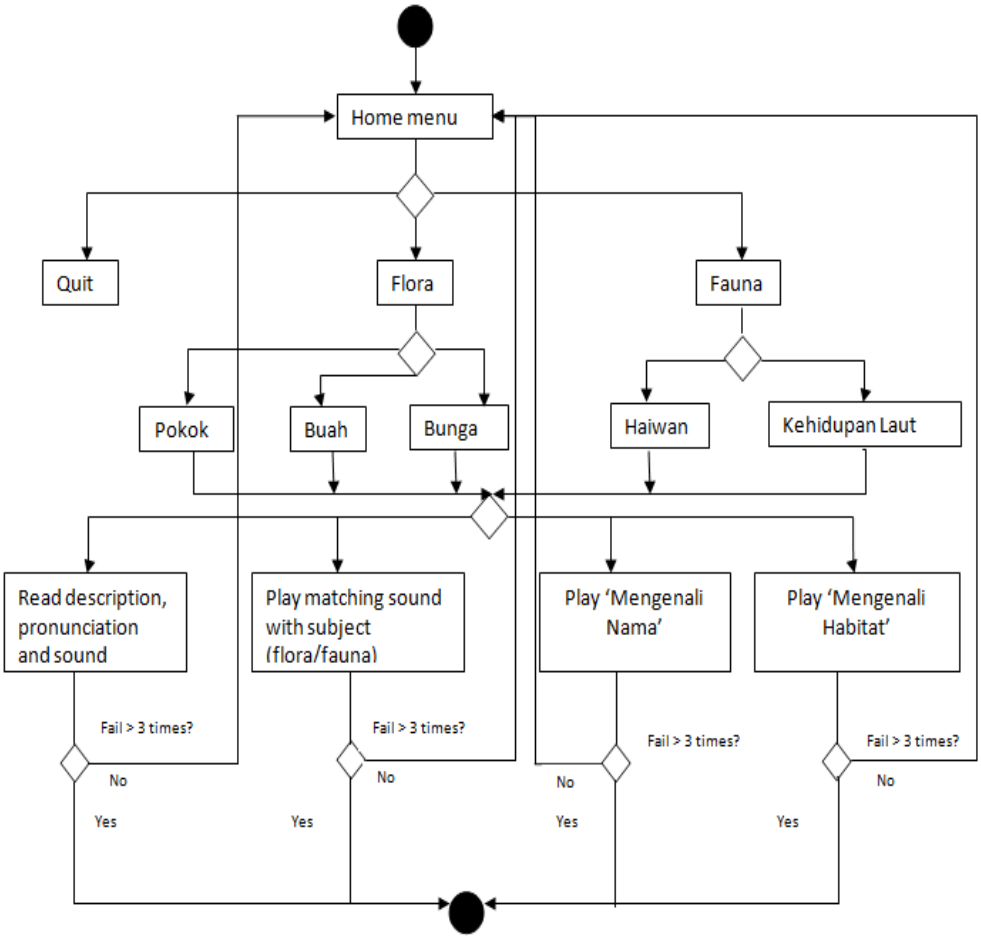


Figure 15: Activity Diagram

CHAPTER 4

RESULT AND DISCUSSION

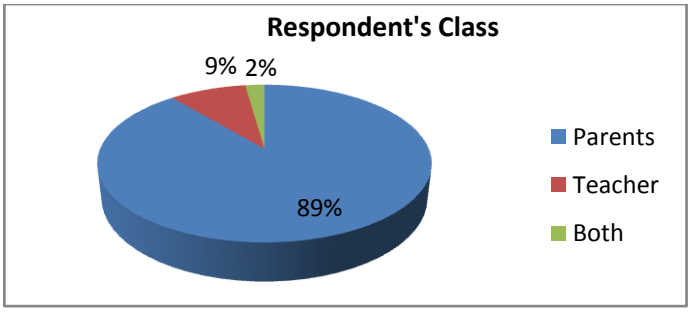
4.1 Data Gathering and Analysis

4.1.1 Pilot Studies - Questionnaire Result

To get early feedback of this project, a set of questionnaire questions had been distributed to the target audience which are kindergarten teachers and parents. The parents were involved in the survey process because their children are unable to answer the questionnaire. Only one preschool has been taken as a sampling which comprises of 45 students. The participating preschool is Tadika Pintas Anak Soleh (PASTI), located at Seri Iskandar, Perak. 23 questions were asked and from 23 questions, 22 questions are closed ended while another one is open ended question to get overall comment from the respondent.

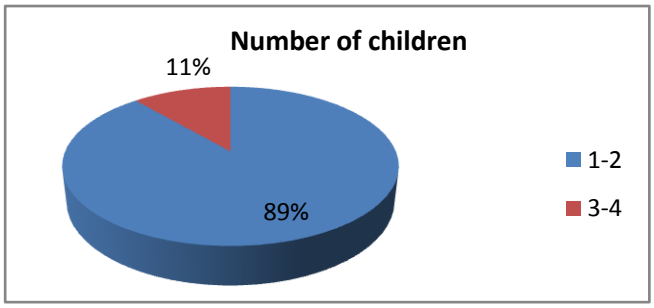
Question 1: Respondent's Class

There are three types of classes that consist of parents, preschool teachers or both. Majority of the respondents are parents followed by teacher and lastly a single respondent from class of both teacher and parents. This question will justify that the following survey results are mostly derived from the parents-children group of respondents.



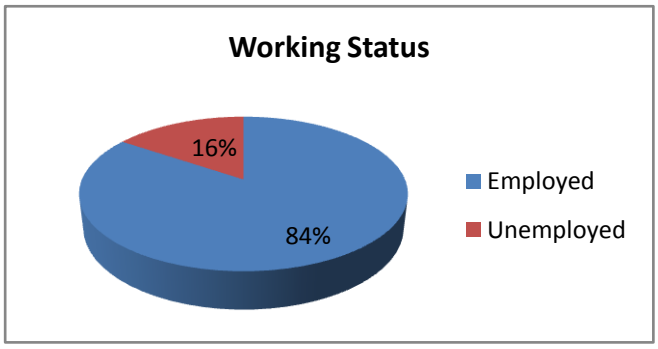
Question 3: Number of children at preschool level

The third question is on the number of children studying in preschool for particular parents. The majority respondents have either one or two children studying in the preschool level. This question is important in order to see the pattern of parents with certain number of children towards their support of this project.



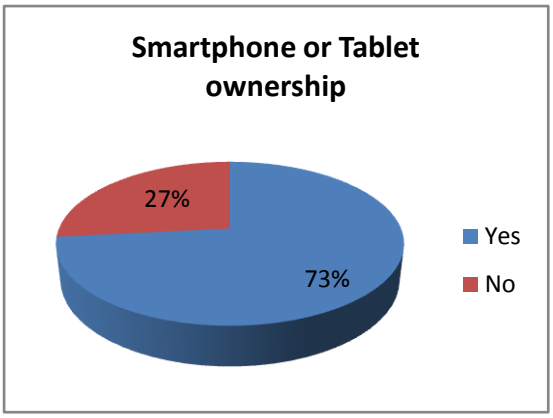
Question 4 and 5: Working Status

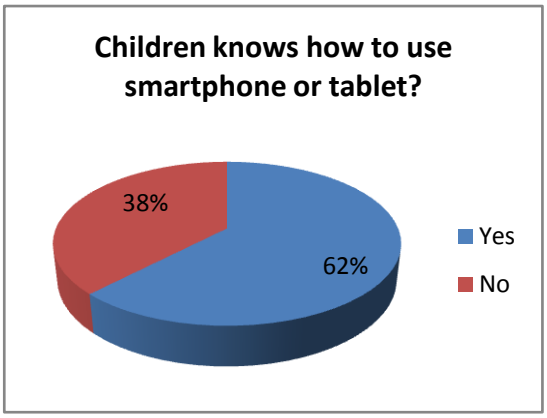
This question points out that most of the parents are working. According to Miss Nadia, the teacher at Tadika PASTI, the kindergarten does not only provide preschool classes, but they also offer day care service. It also gives an overall view that the parents are well educated and easy to accept any changes.



Question 6-7: Smartphone Usage

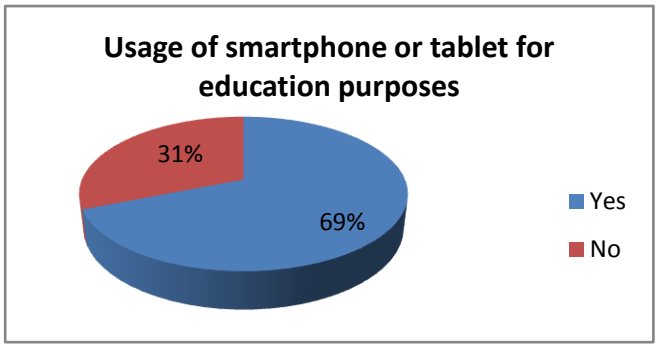
The result shows that majority of the children are exposed to the smartphone or tablet. When the parents have a smartphone or tablet, they will usually allow their children to use or play with the gadget. This shows that the children already establish a connection with the mobile devices. Thus, it is easier for the proposed Android application to be introduced to the preschool children later on.





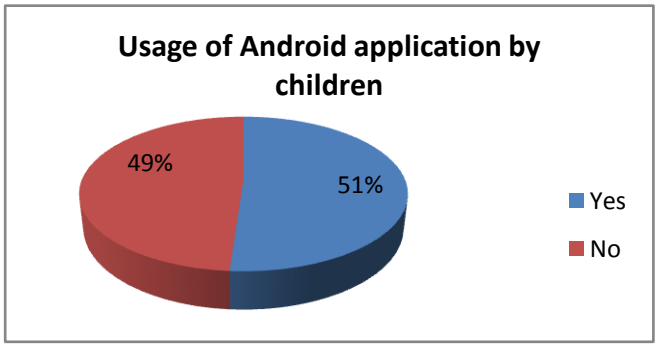
Question 8: Usage of smartphone as a learning medium

From the 45 respondents, 31 support the usage of mobile devices for education purposes. This derived that majority of the parents agree with the trend of using mobile learning on their children. Besides that, the parents are likely to support this project by using the proposed Android application later on.



Question 9: Usage of Android application by children

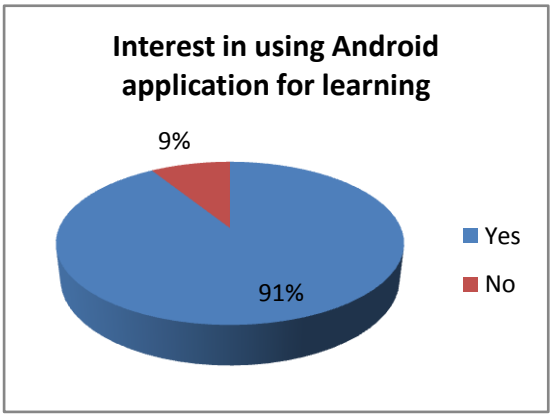
Although 69% of respondents support the concept of mobile learning, however according to the survey, slightly more than half of the respondents' children already experienced in using any Android application. Maybe some of the parents are using a non-Android based mobile phone such as iPhone, Blackberry or Nokia, causing the children never experienced in using any Android application.

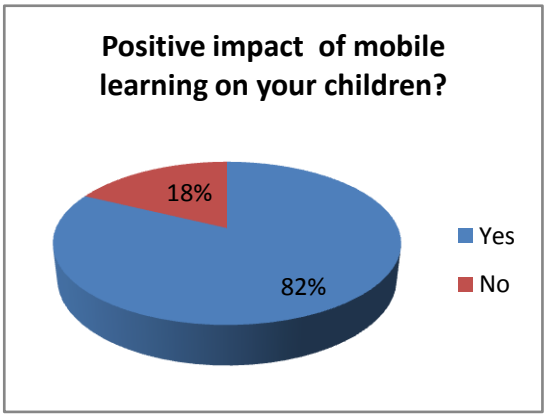


Question 10 -11: Interest of the children in using Android application for learning purposes & the effect in using Android application

Three quarter of the children already created interest in using Android application, regardless of any purposes. To them, it is considered playing as long as the learning modules are fun and interactive. This information is derived from the preschool teachers and supported by the survey result below. Although almost half of the children never experience in using Android application, it does not hinder the children and parents' curiosity towards the proposed Android application.

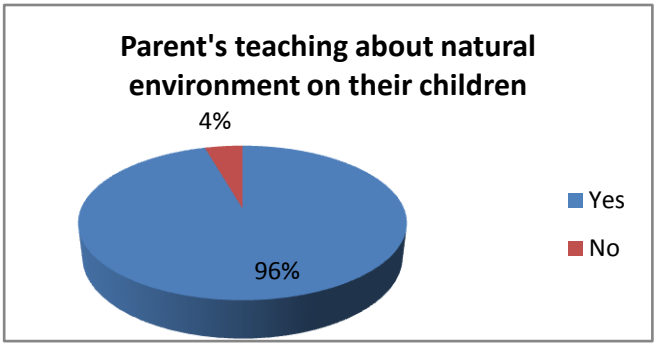
The next question studied on the parents' or teachers' perception on the impact of mobile learning on children. Majority with 69% agreed that mobile learning can bring positive effect to the children. Some of the respondents commented that positive impact can be created under the supervision of an adult, regardless it is a teacher or parents to avoid the children from being too engrossed in using the mobile devices.





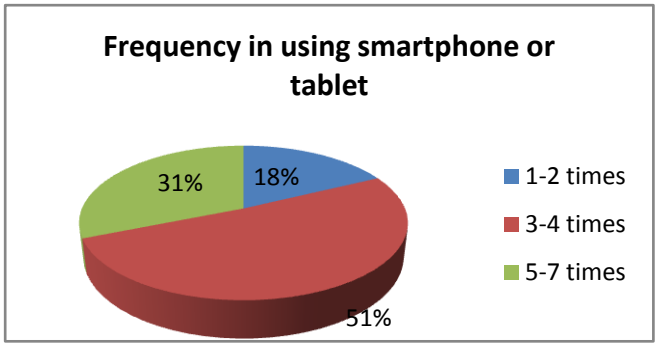
Question 12-14: Learning about Natural Environment

In the survey result, all respondents agreed to the environment education because it is a fundamental concept in life. In addition, majority of the parents have taught their children about the nature. This shows on how the parent sees the importance of environment education towards the children.



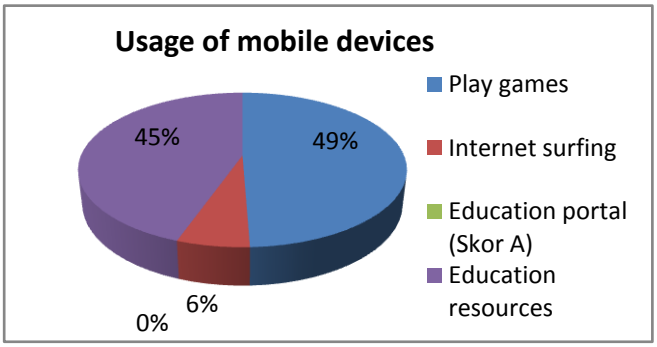
Question 18: Frequency in using mobile devices

The children average usage of mobile devices is between 3 to 4 times per week. On the other hand, 31% of the respondent's child uses the gadget almost every day. This result shows how comfortable the children are with mobile devices and they can use the gadget for their own usage later on.



Question 21: Usage of mobile devices

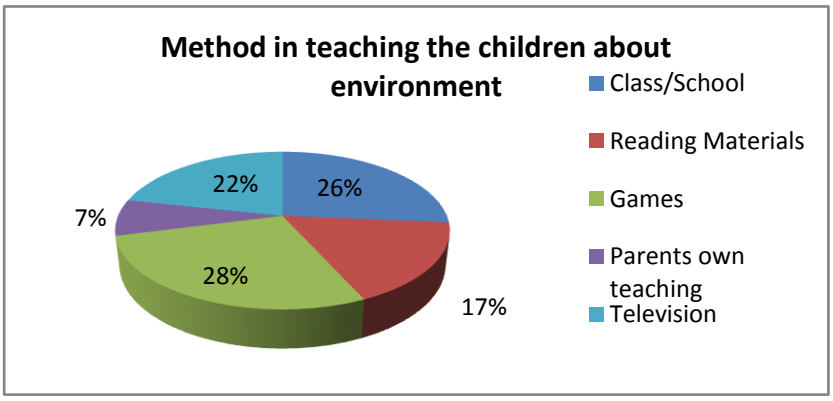
This question allows the respondent to choose more than one answers in order to investigate the usage of mobile devices by children. The highest usage of mobile devices by the children is to play games, followed by usage as an education resources, internet surfing and lastly is the education portal. There is no child subscribed to the education portal such as Skor A. The reason is maybe because of the fee charged for very user's access into the portal. Taking this result into consideration, the author had designed the Android application to have game features in order to attract the children to use it. In addition, free education resources are always welcomed by the parents and teachers.



Question 22: Method in teaching the children about environment

In the questionnaire, there are five types of method that the parents use to educate their children about natural environment. The most chosen method is learning through games. Previously, most of the parents forbid their children to play games because of the negative effect such as laziness and loss of attention to other things. This result shows that the parents viewed gaming as an alternative to educate the children about the theory behind the games, for example the environment.

The second most chosen method is learning in school which is facilitate by the teacher, followed by television, reading materials and parents teaching. The least method is the parents self teaching on their children, with only 7% of the respondents has ever taught their children about nature. One of the objectives of this project is to create an improved parent-child relationship by using the Android application together with their child.



4.1.2 Interview with Tadika Pintas Anak Soleh

In order to develop the proposed application, the author decided to have discussion with preschool teachers. Therefore an interview with a representative kindergarten in the local area known as Tadika Pintas Anak Soleh was setup on 29 June 2012. The kindergarten is located at Bandar Universiti, Seri Iskandar, Perak. The respondent involved is Miss Nadia, a teacher at the kindergarten.

During the interview, the author had shown Ms Nadia the prototype version of FunNature. Overall she commented that the content is good and covered the preschool syllabus. This is a new technology to them because currently they are using books, notes and Microsoft Power Point slides. She responded that the children are currently learning in a good progress although they did not use the latest technology such as courseware.

However, there are some feedbacks given by her. She proposed for the game to have animal's sound to make it more fun and attractive. The author had taken this into consideration and added the sound feature into the app. In addition, she also added that the children are learning about environment through science. Therefore she requested for the app to include on how the plant grows starting from seed onwards. However her request was carefully thought by the author and the author has decided not to include this scene into app due to project limitation.

Other findings from this interview are the Android application content. Both the teacher and author had agreed that the suitable content for the application are names, habitat, sound and description of flora & fauna because it is aligned to the preschool syllabus approved by the MOE. Besides that, the product also focused on Malaysia flora and fauna context in order to stimulate the child's awareness on Malaysia's natural environment.

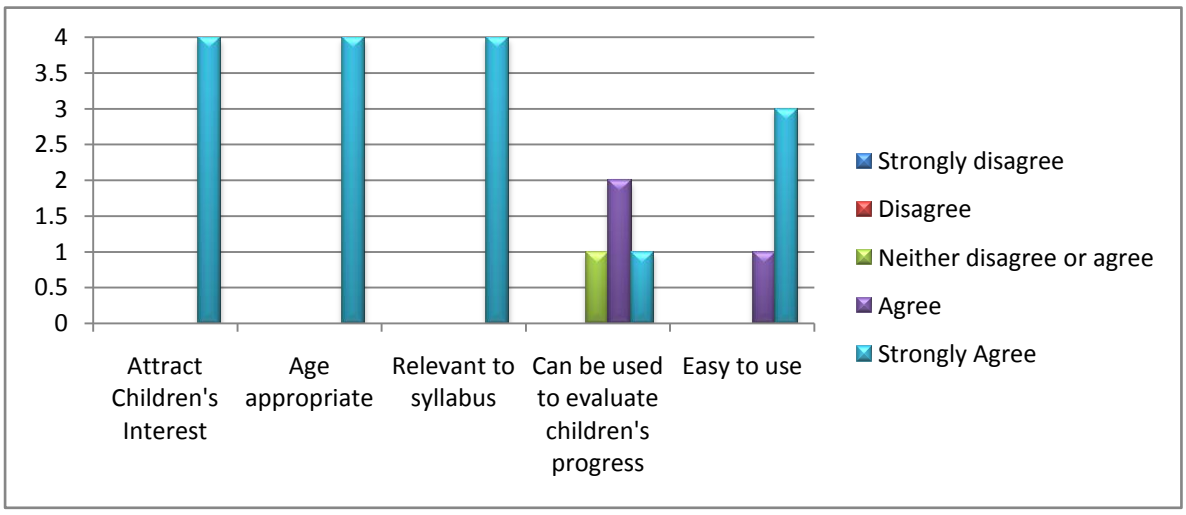
All the above findings have been taken into consideration by the author in developing the final product to ensure that it meets the user requirement and able to attract the children attention. The Android application is further discussed in the next section 4.3 Prototype.

4.2 System Testing

On Monday 30 July 2012, the first system testing was conducted at Tadika PASTI with the help of four preschool teachers and 5 students. The purpose of this session is to gather the teachers' feedback on FunNature prototype. One of the main concerns is to get the teachers' approval whether the content is appropriate for the children and aligned to the MOE syllabus. Apart from that, teachers were asked to give comment on the overall user interface of FunNature, such as colours, text size and sound.

Figure 16: Teachers of Tadika PASTI trying FunNature Android application

After given enough time to play with the application, the teachers were asked to complete the questionnaire, as attached at the Appendix B. The teachers' feedback from the system testing is illustrated in the graph below:



The first system testing shows that from the teachers' perspective, FunNature Android application is able attract children's interest, age appropriate, relevant to the content teaching in the classroom. Thus, this application can be used as an alternative to the traditional games. However, the teachers doubted the usefulness of this application as a medium to evaluate the children progress because of its simplicity. It is hard to track the student's performance because the activities are not recorded in any database and student's account cannot be created in the Android application.

Lastly, the user friendly feature are rated highly although for the first time the children might face some difficulties in holding the tab and clicking the button, but after playing for a while they started to get used to the Android application. Thus the teachers believed that if they have the chance to play it more often they will be able to use the Android devices better and faster.

The final product of this application has been completed and the expected date for the User Acceptance Testing will be on 3rd August 2012 with the 45 students of Tadika PASTI. There are two objectives of this User Acceptance Testing. The first one is to get feedback from the children about the FunNature Android application interface and features. The second objective is to measure the improvement of the children in identifying flora and fauna after using this product. It is hoped that a minimum 10% increase in children's ability to identify flora and fauna is achieved by using this application.

4.3 User Testing

The two objectives of User Testing are to achieve minimum 10% increase in children's ability to identify flora and fauna after using the application and to observe children interaction with the application. A number of 18 students aged 4 years old have been chosen to be the respondent for this testing. A set of questions consisting of animal and plant images were distributed to the children twice. The first set is given before they use the Android application and the second set is given after they had played the modules. In order to measure the improvement in object recognition, the same sets of questions are used in both sessions. Table 3 shows the user testing result to identify the improvement.

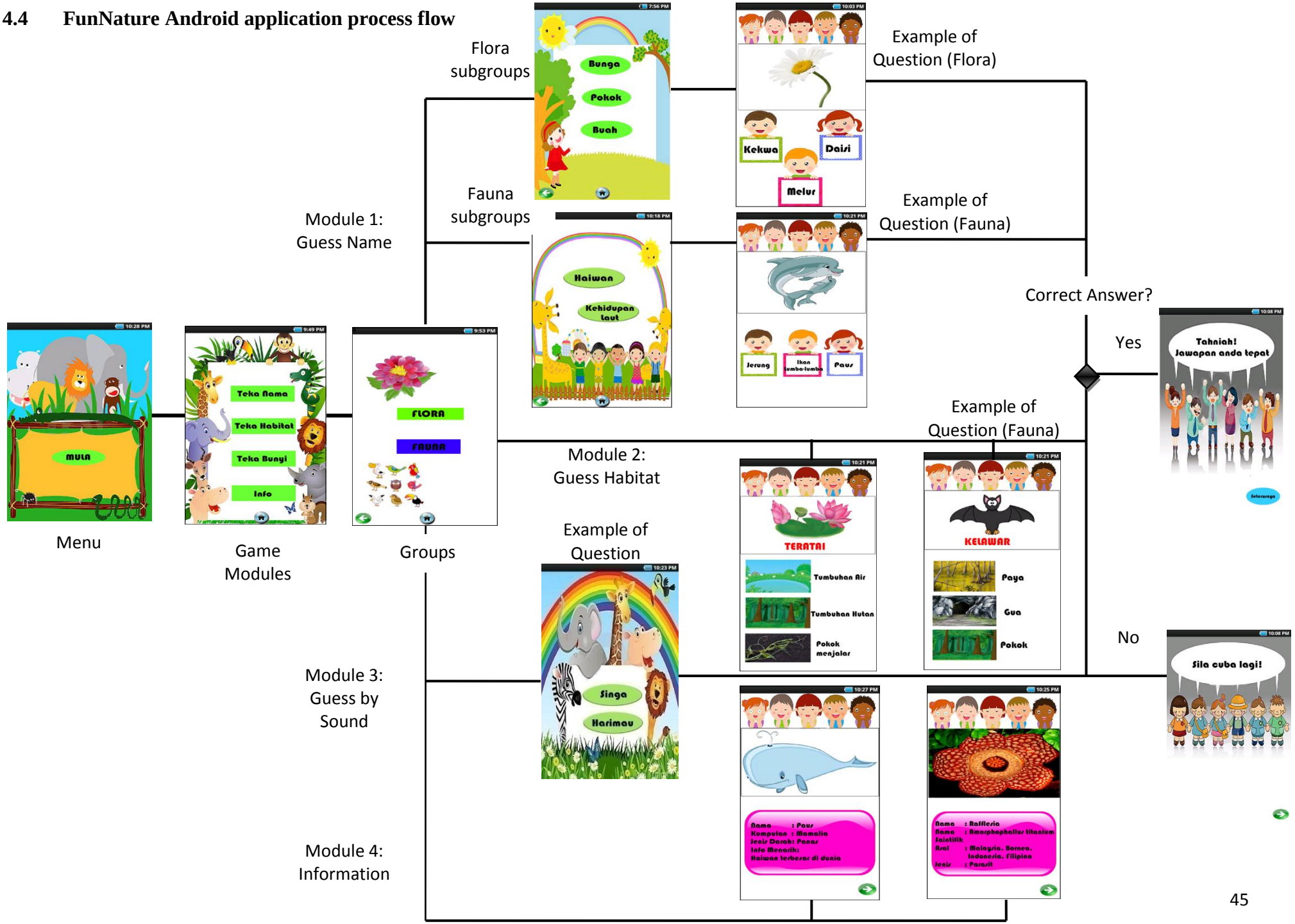
	Before		After		Improvement	
Object	Correct	False	Correct	False	Fraction	%
Bunga Raya	11	7	14	4	3/7	42
Kekwa	8	10	14	4	6/10	60
Ros	18	0	18	0	0	0
Tebu	9	9	15	3	6/9	66
Paku-pakis	2	16	7	11	5/16	31
Pokok kelapa	11	7	12	6	1/7	14
Kancil	7	11	13	5	6/11	54
Badak air	14	4	18	0	0	0
Kura-kura	16	2	18	0	0	0
Total	96	66	129	33		
Improvement in Wrong Answers	66/(96+66)= 40.7%		33/(33+129)=20.4%			

Table 4: User Testing Result

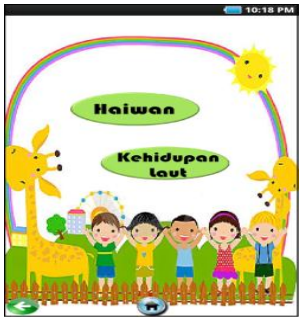
Referring to Table 4, the total of false answer during the first set of questions is 66 over 162 questions. However, after the children had played with the modules, the number of false answer has reduced to 33 only. This illustrate that an average of 20.4% reduction in false answer has been achieved during the user testing.

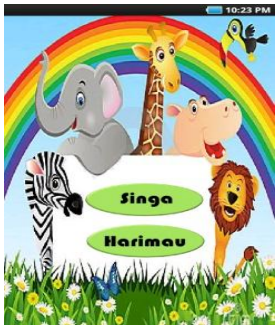
From the observation during user testing session, the children know what to do although there are no questions given in the modules. It is proved that the children learn best using game method provided that the game are user friendly, age appropriate, interactive and has a wise content. From the user testing, it is identified that children aged 4 years old are not interested in using the 'Info' module. Thus, the author concludes that the 'Info' module may be suitable for children aged 6 years old and above.

4.4 FunNature Android application process flow



4.5 Prototype of FunNature android application

Page	Description
	This is the start screen of FunNatur android app. User can click 'Mula' button to start.
	This screen shows four type of modules or activities that the user can perform with the application such as 'Teka Nama','Teka Habitat', 'Teka Bunyi' and 'Info'.User can click any four button to start.
	The first module, after clicking the 'Teka Nama' or 'Guess Name'button, user will be directed to the option screen. There are two main groups which are flora and fauna.
	If the user clicks on the 'fauna' button, user will be directed to this page. There are two subgroups which are underwater world and animal.
	For example, when the user click on the button 'Kehidupan Laut', questions on underwater creatures will be ask. The images of kids will be used as a button.

	This screen is shown when the user click on the accurate answer. Based on the example previously, if the user clicks the 'middle kid', he will be directed to this page.
	This screen is shown when the user click on the wrong answer. Based on the example previously, if the user clicks the first kid holding a 'Jerung' or 'Shark' button, he will be directed to this page.
	When the green coloured arrow button is click, the next question will pop out. This applied to other groups or modules as well.
	This is the page of 'Teka Bunyi' or 'Guess Sound' game module. After the user click on the button 'Teka Bunyi' on the modules page, he will directed to this page and an animal sound will automatically be played. User need to choose the correct answer from the two buttons given.
	This is the page of 'Teka Habitat' or 'Guess Habitat' game module. User need to click either picture or text of the given options.
	This is the 'Info' page that gives description about flora or fauna to the user. There are voice narration and sound included in this page.

CHAPTER 5

CONCLUSION

5.1 Relevancy to objectives

As a conclusion, by developing the FunNature android application, it can help to solve the problems that have been discussed earlier under the section 1.2 because it has the functionalities needed according to the objectives of the system development. It is believed that by using this app, children can pay more attention in learning about the nature. Parents and teachers can spend their time with the children by playing the games together. Hence, they can also explain more about a particular animal or plant as per displayed in the screen.

This study also requires the author to study on the theory and development of mobile application in order to successfully complete the project. Under section 2.0, various mobile phone market shares and mobile operating system (OS) market shares have been discussed and it provides justification on why the author had chose Android for the targeted platform.

Chapter 3 shows the development process of FunNature, and it was designed and developed according to the user requirements. Multiple methods such as questionnaire, interview and system testing was done to ensure the suitability of the project. Based on the feedback provided by teachers, FunNature is able to capture the children interest and the content is appropriate according to the MOE preschool syllabus. In addition, the objective of minimum 10% improvement in flora nad fauna recognition has been achieved in the user testing. It is hoped that the preschool children are able to utilize this android application for their advantage, to not only playing games but also indirectly learn about the nature in a fun way.

5.2 Suggested Future Works for Expansion and Continuation

5.2.1 Conduct Further Research

Further research in the future is needed, especially in the main area of this project which is environment domain and children learning. For the mean time, FunNature only consist two main components of environment namely flora and fauna. Research into other components of environment such as the weather, atmospheric level or the outer space can be done to enhance the credibility of the project.

In addition, a research into new multimedia tools that can help to enhance FunNature's features can be conducted. For example, FunNature Android application also can be develop for iOS platform in order to reach more users compared to the current target Android users.

5.2.2 Build More Modules

There are four modules in FunNature Android application available for the children to play. For future development, it is best if more modules can be added into the application. For example, a puzzle game that allows children to arrange pieces of a flora or fauna picture that will stimulate the children mental development. By playing puzzle, they will be able to exercise their mental image of a given object.

5.2.3 Enhance FunNature functionalities

As discussed in Chapter 4, the limited functionalities of FunNature inhibit its usability as a medium for the teacher to measure the children progress. Therefore, in order for this Android application to be able to monitor children learning progress, it needs to have student account and login functionalities. Thus, teachers can view their student accounts and the games score of each student.

REFERENCES LIST

[1] Appiction.(n.d.). *Advantages of Android Development.* Retrieved 1 November 2011, from http://www.appiction.com/Advantages-of-Android-Development

[2]BBC (2011). *Apple overtakes Nokia and Samsung as smartphone maker*. Retrieved 29 October 2011, from http://www.bbc.co.uk/news/business-14337388

[3] Berk,L E. (2006). Child Development. Boston, Pearson Education, Inc

[4] CNet (2012). *Android reclaims 61 percent of all U.S. smartphone sales.* Retrieved 20 June 2012 from http://news.cnet.com/ 8301-1023_3-57429192-93/android-reclaims-61-percent-of-all-u.s-smartphone-sales/

[5] Clegg, D. & Barker, R. (2004). *Case Method Fast-Track: A RAD Approach*. Addison-Wesley.

[5]Davis, J. (n.d). *Young children,environmental education and the future*. Retrieved 15 June 2012 from http://eprints.qut.edu.au/1309/1/davis.pdf

[6]Erickson(2008).*The Children and Nature Network.* Retrieved 20 June 2012 from http://www.naeyc.org/files/yc/file/200801/BTJNatureErickson.pdf

[7]Fuks (2004). *Environmental Education and Nature Schools in Denmark.* Retrieved 15 June 2012 from http://diggy.ruc.dk/bitstream/1800/334/1/Environmental_education_and.pdf

[8] Uzunboylu, H. et al (2009*). Using mobile learning to increase environmental awareness*. Journal of Computers & Education. 52 : (2009) 381–389

[9]Hinds, J. & Sparks, P. (2007) . *Engaging with the natural environment: The role of affective connection and identity*. Journal of Environmental Psychology . 28: (2). Page 109-120

[10] Holt, J. (1995). *How Children Learn.*New York: Perseus Books Group

[11] Ma, X., & Bateson, D. J. (1999). *A multivariate analysis of the relationship between attitude toward science and attitude toward the environment*. The Journal of Environmental Education, 31(1), 27–32

[12]Ministry of Education (2010). *Kurikulum Standard Prasekolah Kebangsaan*. Retrieved 20 June 2012 from http://www.moe.gov.my/bpk/v2/index.php

[13]mobiThinking (2011).*Global mobile statistics 2011*. Retrieved 20 October 2011, from http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats

[14] NAEE North American Association for Environmental Education (2010). *Early Childhood Environmental Education Programs: Guidelines for Excellence*. Washington D.C

[15]Newark-French, C. (2011). *Mobile Apps Put the Web in Their Rear-view Mirror*. Retrieved 29 October 2011, from http://blog.flurry.com/bid/63907/Mobile-Apps-Put-the-Web-in-Their-Rear-view-Mirror

[16] Olfman, S. et al.(2003). *All work and No Play*.Westport, Praeger Publishers.

[17]Pritchard, A.(2009). *Ways of Learning theories and learning styles in classroom.*New York : Routledge Taylor & Francis Group

[18]Qaiser (2010). *Google Android Share Vs Apple iOS Share in U.S.* Retrieved 29 October 2011, from http://www.letmedefine.com/android-ios-share/

[19]Reed, B. (2011). *Android market share nears 50% worldwide.* Retrieved 29 October 2011, from http://www.networkworld.com/news/2011/080111-canalys.html

[20] Saracho, N. & Spodek, B. (2003). *Contemporary Perspectives on Play in Early Childhood Education.* Information Age Publishing, Inc..

[21]Tilden, F. (1977). *Interpreting Our Heritage*. Chapel Hill, NC: University of North Carolina Press.

[22]Vangsnes et. al. (2011). *Computer games in pre-school settings: Didactical challenges when commercial educational computer games are implemented in kindergarten*. Computers & Education 58 (2012) 1138–1148

[23] Verenikina, I et al. (2003). *Child's Play: Computer Games, Theories of Play and Children's Development*. IFIP Working Group 3.5 Conference: Young Children and Learning Technologies, UWS Parramatta; Australian Computer Society, Inc.

[24] Verenikina, I et al. (2008).*The affordances of computer play in young children: A preliminary study*. University of Wollongong.

[25] Verenikina, I et al. (2006). *Computer Play, Young Children and the Development of Higher Order Thinking: Exploring the possibilities*. University of Wollongong.

APPENDIX A

FunNature Android Application: Pre-market Survey

Question 1 – 10: Please tick (✓) in the respective box. Choose one (1) answer only.

1. You are a
   ( ) Parents ( ) Pre-school teacher ( ) Both

2. Gender
   ( ) Male ( ) Female

3. Number of children in preschool (Age 5-6 years old):
   Please state the number: _____

No	Question	Yes	No
4.	Are you working?		
5.	Is your spouse working?		
6.	Do you have smart phone and/or tablet at home?		
7.	Do your children know how to use smart phone and/or tablet?		
8.	Do you support the usage of smart phone and/or tablet as a learning medium?		
9.	Do you agree that Android app can be used as a learning medium?		
10.	Do you ever use any multimedia learning products for your children?		
11.	In your point of view, do kids aged 5-6 years old are interested in using the multimedia learning products?		
12.	Do you think multimedia learning will give positive effect on your children achievement?		
13.	Do you support the learning about natural environment for your children?		
14.	Did you ever taught your children anything related to the environment?		
15.	Do you have extra time to teach your children about our environment?		
16.	Do you think it is feasible to learn about environment using Android app?		

17. Rate the following features that should be available in the learning Android application:

Features	Strongly Disagree	Disagree	Average	Agree	Strongly Agree
Interactive					
Animation					
Sound/song					
Video					
Static Image					

18. How many times a week your children use smart phone or tablet?

( ) Everyday
( ) 1 – 2 times a week
( ) 3 – 4 times a week
( ) 5 – 7 times a week

19. At what age do you think it is suitable to teach the children about environment, e.g. flora and fauna?

( ) Below 5 years old
( ) 5-6 years old
( ) 7-9 years old
( ) 10-12 years old
( ) Others (State):_____

20. How often do you play game or do activities related to environment with your children?

( ) About 1 hour per week
( ) Every weekend
( ) Once a month
( ) Never
( ) Others: _____

Question 21 – 22: Please tick 1 or more answer

21.Smart phone or tablet is used by your children to….

( ) Play games
( ) Surf internet
( ) Learning medium
( ) Homework

22.How do you teach your children about environment, e.g. flora and fauna?

( ) School/class
( ) Reading materials
( ) Games (PC)
( ) Games (Smart phone or tablet)
( ) Television

23. Please state any comment or improvement about learning environment through mobile (Android) application?

_____
_____
_____
_____
_____

Thank you for your cooperation!

APPENDIX B

FunNature Android Application: First System Testing (Teachers' Feedback)

System Feedback Survey

Section A: General Information

1. Name: _____
2. Gender ☐ Male ☐ Female
3. Year of experience in teaching preschool level

   ☐ Less than 5 years ☐ 5-10 years ☐ over 10 years

Section B: System Feedback

Please rate the following according to your opinion.
(1= Strongly Disagree to 5 = Strongly Agree)

	1	2	3	4	5
1. The system is able to attract children's attention.					
2. The system is appropriate for age 4-6 years old.					
3. The system is relevant to the teaching syllabus in the preschool.					
4. The system can be used to evaluate children's progress.					
5. The system is easy to use.					

-Thank you for completing this survey-

APPENDIX C – Technical Report

Android Application for Learning about Environment (FunNature)

Latifah Alia binti Mohd Jamaraji
Department of Computer and Information Sciences,
Universiti Teknologi PETRONAS
Bandar Seri Iskandar, Tronoh Perak, Malaysia
aliajmrj@gmail.com

Ainol Rahmah Shazi binti Shaarani
Department of Computer and Information Sciences,
Universiti Teknologi PETRONAS
Bandar Seri Iskandar, Tronoh Perak, Malaysia
ainolars@petronas.com.my

***Abstract* — This paper is about the development of Android Application for Learning about Environment. This project is a multimedia based project and the targeted user is preschool children age between 4 to 6 years old and this application is developed to teach the children about flora and fauna. The prototype of FunNature Android application is developed using Adobe Flash Creative Suite 5.5. The objective of the project is to develop Android application prototype and to demonstrate a minimum 10% improvement in object recognition through image, text and sound by conducting a user experience testing on the prototype. The project looks at the related works by researchers from various scope of study which includes Android application, children learning style, MOE preschool curriculum and environment domain. The application is developed using Rapid Application Development (RAD) methodology and Android has been chosen as the mobile platform to optimize the capability of the Android technology and to leverage on its market potential.A user experience testing was conducted with the preschool children. The result showed that an average of 20% improvement is achieved after the children had used the proposed Android application.**

Keywords - Android; Nature; Environment; Preschoolers

I. INTRODUCTION

The title for this project is FunNature Android Application, an application that incorporates the game features into it for the children to learn about the environment especially flora and fauna. Therefore, the focus of this project is to do research on the related disciplines in order to make sure that the final outcome is aligned with the needs and requirements as well as to develop Android application named FunNature. The main areas that were being investigated for this research are environmental education and Android technology

Responds from the students varies based on their age [7] Different positive attitudes toward the environment were expressed by different grades. The target user for this application is preschool children because they tend to give more positive attitude to the environment compared to the older students. However, children should not be burden with environmental problems because they do not have enough coping skills to understand the real issue of environment.

The Android application is interactive and interesting due to the combination of images, animation and sound presented. This application will be able to be play repeatedly on any Android-supported devices according to the preschoolers need. The application is user friendly making it an advantage for the children to use it easily.

At the end of this project, the prototype can be used as a learning aid to assist the teachers and parents in teaching children about nature. This is an alternative way for them apart from the traditional method which is using reading materials such as revision books, flash card and colouring book. There is also a need for parent-child quality time and parents can spend more time with their child by playing the game modules in the application together. The Android application is relevant to the children because it can assist them during class or field trip. Interactive learning medium is needed to ensure that the children focus is towards the learning subject and this application helps the teacher to achieve an enjoyable learning process.

The scope of study cover the Ministry of Education approved preschool curriculum, environment domain and identify the most suitable platform to develop this application. Due to the time constraints, this project will only focus on flora and fauna domain only.

II. LITERATURE REVIEW

A. Children Learning

Learning is not only exclusive to the education system, but it happens a long time before school, continues and grow rapidly during school [11]. Learning is divided into many approaches but the main purpose is to develop new knowledge and skill to groom the person to be better. There are two types of children development; physical and psychological. It is easy to monitor the physical development as it can be seen externally and usually happen

naturally. On the other hand, psychological development results from the children daily activities and play. The language and thought grows quickly thus they start to have more conversation and develop relationship with others [1]. Piaget theory added that in pre-operational stage, children aged 2 to 7years old are able to represent ideas and mental imagery through learning medium. The usage of symbolic thought and imagination also occurs at this stage [11].

It is a common nature among children that they like to play because playing is a natural part of the children behaviour [12]. Teachers should be aware of the importance of playing in children's daily activities because it is not only a spontaneous or enjoyable activity but actually it also help in the process of children's psychological development [15].

The attention span of children varies with age, gender and type of activities they participate. In general, children's attention span develops two minutes per year as children grow. A 3-year-old child will have at least six minutes attention for any activities they participate. However they will be able to maintain a longer attention and concentration on the activities that match their interests [10].

B. Children and Nature

The children are best to be nurture with love and appreciation towards nature since they are young. There is less need for formal education in teaching the children since the parents can involve their child with activities that will indirectly teach about nature [4].

There is a difference between adults and early childhood environment education. Early childhood environmental education focuses on conservation concepts to build a positive understanding towards the nature and anything negative issues such as endangered species or environmental degradation should be avoided. Children will respond with sadness or fear because they do not have the coping skills to face such tragedies. They are also a better information receiver than adults because they can learn new words at a better rate and the level of eagerness to learn about something can be visually seen [13].

Formal education at school or informal learning through family activities can help children to gain knowledge about nature and build interest. To get children closer to the nature, they must engage in positive and active experiences in nature. As a result, the experiences indirectly contribute to raise environmental awareness in addition to other factors [18].

Respond toward nature differs based on children location. Children who live in rural areas are more likely to respond positively to nature compared to the urban peers. They also find that activities preferences differ between both groups. Rural children tend to do activities such as camping or caring for animal while urban children are less likely to involve in similar activities [6].

C. Learning through Games

In this digital age, computer is a part of life by assisting us to perform daily routine. Although there are many arguments when children spend too much time with computer or television, most parents enjoy seeing their children exploring the technology because they can learn and play at the same time. However, parents need to monitor the children so that they will not spend excessive time with technology [16].

Software providers are targeting children because although the parents pay for the games, but the children are the main user. Currently, the number of educational software or game has increase substantially especially for this target group. In order to attract the children interest, the educational game is developed with a playful and interactive manner [17].

Preschool children usually already know how to play the games and to them, games are meant to be play together with friends. Children always take part voluntarily when playing game because it is less structured and fun. They also viewed that games is some sort of competition, because player need to solve problem and gain points to proceed to the next level. This characteristic helps to develop the children's mind on how to survive in the game. Educational games are also considered as a medium of learning and preschool teachers are adopting this activity into the children's curriculum for a better academic syllabus. The pedagogical games can be used to teach many subject matters such as language, number or science. [14].

D. Malaysia National Standard Curriculum for Preschool

The syllabus currently used by all preschools in Malaysia was last updated in 2010 by the Ministry of Education. The responsible party to draft and approve the curriculum is the Curriculum Development Division, MOE. In the curriculum, the study of environment is grouped under Science and Technology core, Section 3.0 ST [8]. The section is further into 4 subsections but only 3 subsections are related to this project as illustrated below:

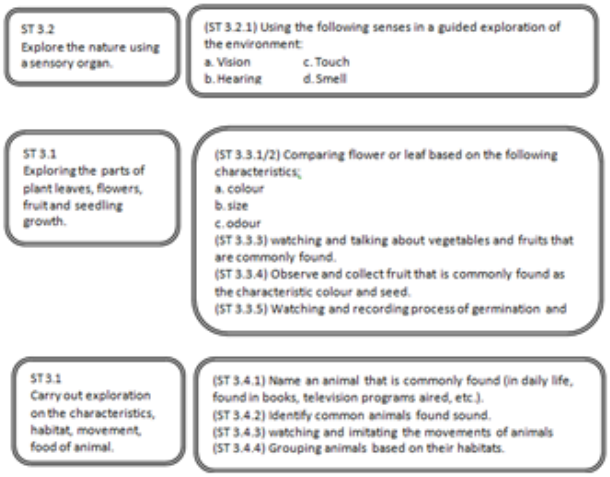


Figure 1: Social & Technology core, Environment Section (MOE, 2010)

E. Mobile Application

Today, more time is spent by the users on the mobile application compared to Internet and it is higher by 9%. The changes are significantly drastic because in June 2010, average users spent only 43 minutes per day using the mobile application and the number almost doubled on June 2011 with 81minutes spent on application. The drastic change on the usage of mobile application is caused by more sessions made by each user per day and not because of the longer average time spends for each session [9].

Mobile application is software that runs on mobile phones particularly smart phones or tablet. Over 110,000 mobile applications had been developed daily and more than 15 million consumers are using this application [5]. The most prominent advantage of mobile application is that it can provide interactivity which is absent in traditional method such as reading materials. Learning about nature using mobile applications is more interesting than using any revision books because of its interactivity, user friendly and game-like feature.

F. Mobile Application Share Market

The top four mobile operating software (OS) in the world from first quarter of 2011 until first quarter of 2012 are Android OS,iOS, Windows Phone 7 and Blackberry RIM. The OS share of Android rose from 49% at the Q4 of 2011 to 61% at Q1 of 2012 while at the same time its strongest competitor, iOS dropped its share from 41% to 29% [2]. Based on the market share, it can be conclude that Android OS will be holding more market share in future and this will guarantee more target users for the proposed application.

III. METHODOLOGY

A. Research Methodology

FunNature is developed using Rapid Application Development (RAD) model. This model is more effective to be implemented compared to the other SDLC model because of its suitability with a tight time-scale project development.There are four phases consisting of analysis and quick design, prototype cycles, testing and implementation.

Figure 2 : Rapid Application Development Model

B. Tools and Equipments

Tools	Specification
Operating System	Microsoft Vista Home Edition
Memory	2 GB RAM
Peripheral	Printer, scanner, keyboard, mouse, monitor
Development platform	Android
Software development	Adobe Flash CS 5.5

Table 1: Specifications of hardware and software

C. System Framework

Figure 3: System Framework

The system framework of the FunNature Android application is made up of four components; web server, mobile application, mobile device and the end users. The architecture for this project is simple because the application will only run locally on the device with no communication against other systems. This type of Android application is called as native application.

D. Prioritized List of Requirements using MoSCow approach

M – MUST	- Read description on flora and fauna - Play 'Guess game' that guess the name of the displayed animal or plant - Play 'Guess game' that guess the habitat of the said flora or fauna - Play matching voice/sound with animal
S – SHOULD	- Have background sound and voice
C – COULD	- Gain points
W – WONT	- Description in other language

Table 2: List of requirements using MoSCow approach

In this approach, the requirements are divided into four different levels [3].The first level is the 'must' have requirements which is essential to create the application. Children can play the four main modules listed above. The application also 'should' have background sound and voice to attract children attention. It is suggested that the game 'could' track the points for each successful stage and the player can view the highest mark based on previous game. However, due to time limitation, the author decided not to include the said feature. For the future, it is recommended that the application will be developed for other languages such as Mandarin or Tamil.

E. Activity Diagram

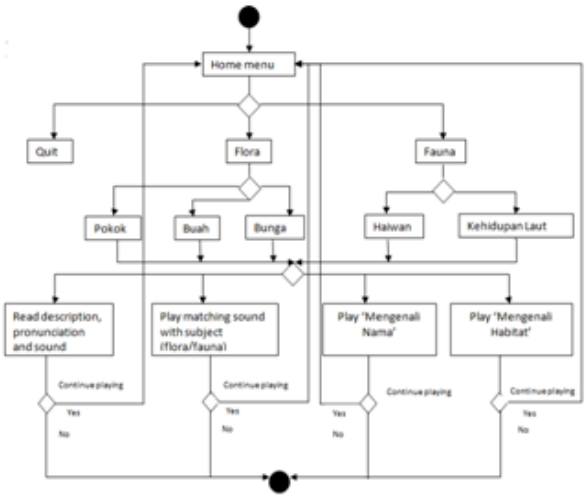


Figure 4: Flow of activities in FunNature

The activity diagram illustrates the different activities in the FunNature Android application. The flow of the system is given and it illustrates what are the options available for the user. The application consist four main modules which are the "Teka Nama", "Teka Bunyi", "Teka Habitat" and "Info".

IV. RESULT AND DISCUSSION

A. *Prototype*

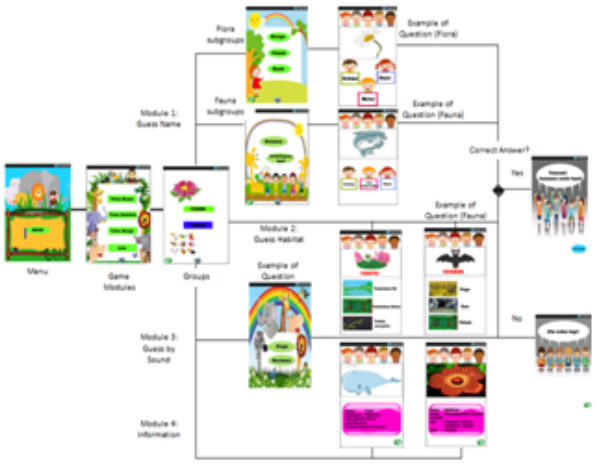


Figure 5: FunNature application process flow

In FunNature application, there are two main groups of environment that the author focused on which are flora and fauna. The four game modules the user can perform with the application are 'Teka Nama','Teka Habitat', 'Teka Bunyi' and 'Info'. In 'Teka Nama' user has to select the correct answer for the name of a given object, while in 'Teka Habitat' user need to select the right habitat for the animal or plant. In contrast, user need to guess what is the animal by listening to the animal sound. Lastly, the "Info" module provides information about flora and fauna in Malaysia.

Once the user choose the module, he can select any subgroups based on first main group he had chose earlier on. For example, when he select Flora group, the subgroup of Flora will be "Bunga", "Buah" and "Plant". In contrast, the Fauna subgroups are "Haiwan" and "Kehidupan Laut". After that, a series of question related to the chosen module will appear and user can play other modules only after he has completed the earlier module. Besides that, user can also repeatedly play the games without any limitation.

The courseware prototype was successfully tested on an Android device – Samsung Galaxy Tab 7. The first phase of result is the survey with parents as the respondents followed by an interview with the kindergarten teacher. Two system testing were conducted with the teachers and preschoolers as the respondents respectively to measure whether the objectives have been achieved or not.

B. *Pilot Study – Questionnaire Results*

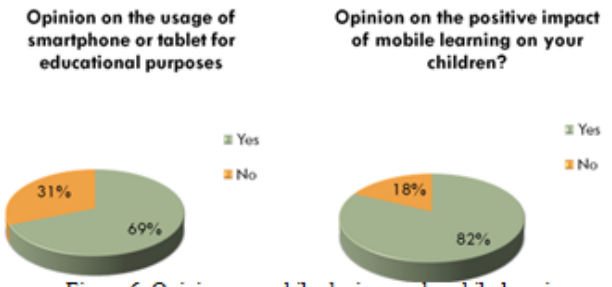


Figure 6: Opinion on mobile devices and mobile learning

During the initial stage of system development, a survey was conducted with 45 parents of Tadika Pintas Anak Soleh students as the respondents. From the total of 23 questions, one of the question highlighted that more than half of the parents agreed that the mobile devices can be used for educational purposes. This is supported by another 82% of parents agreed that mobile learning can bring positive influence on their child learning development.

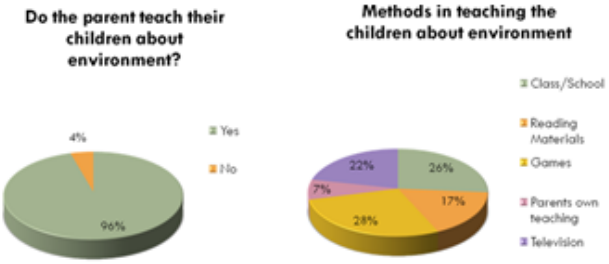


Figure 7: Questions on Environmental education

Almost all respondents have taught their child about environment and this symbolizes that how the parents see the importance of environment education on their children. In addition, out of five methods used to teach the children, the most common method used by the parents is games, followed by class, television, reading material and own teaching.

C. *Interview*

The interview was conducted with the cooperation of Ms Nadia, teacher of Tadika Pintas. During the interview, she was shown the first prototype of the application. She commented that the content is good and covered the preschool syllabus. This is a new technology to them because currently they are using books and Microsoft Power Point. She responded that the children are currently learning in a good progress although they did not use the latest technology. Based on the interview, it is identified that the children are attracted to sounds and voices. As a result from the interview, suggestions such as incorporating science domain into the application as well as inserting animal

sounds have been taken into consideration in developing the final product to ensure that it meets the user requirement.

D. System Testing

The first system testing was conducted at Tadika Pintas with the help of four preschool teachers and 5 students. The purpose of this session is to gather the teachers' feedback on FunNature prototype. One of the main concerns is to get the teachers' approval whether the content is appropriate for the children and aligned to the MOE syllabus. Apart from that, teachers were asked to give comment on the overall user interface of FunNature, such as colours, text size and sound.

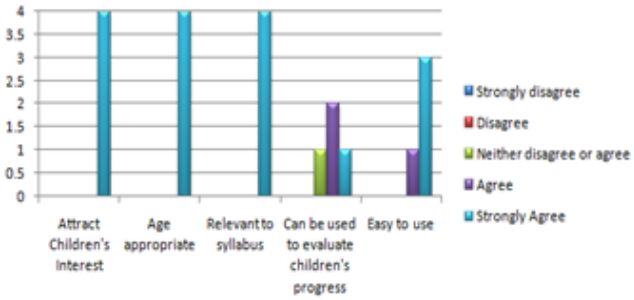


Figure 8: Teachers' Feedback on FunNature application

Based on the system testing, it is identified that the application is able attract children's interest, age appropriate and relevant to the content teaching in the classroom. Thus, this application can be used as an alternative to the traditional games. However, the teachers doubted the usefulness of this application as a medium to evaluate the children progress because of its simplicity. It is hard to track the student's performance because the activities are not recorded in any database and student's account cannot be

Lastly, the user friendly feature are rated highly although for the first time the children might face some difficulties in holding the tab and clicking the button, but after playing for a while they started to get used to the Android application. Thus the teachers believed that if they have the chance to play it more often they will be able to use the Android devices better and faster.

E. User Testing

The two objectives of User Testing are to achieve minimum 10% increase in children's ability to identify flora and fauna after using the application and to observe children interaction with the application. A number of 18 students aged 4 years old have been chosen to be the respondent for this testing. A set of questions consisting of animal and plant images were distributed to the children twice. The first set is given before they use the Android application and the second set is given after they had played the modules. In order to measure the improvement in object recognition, the same sets of questions are used in both sessions. Table 3 shows the user testing result to identify the improvement.

	Before		After		Improvement	
Object	Correct	False	Correct	False	Fraction	%
Bunga Raya	11	7	14	4	3/7	42
Kekwa	8	10	14	4	6/10	60
Ros	18	0	18	0	0	0
Tebu	9	9	15	3	6/9	66
Paku-pakis	2	16	7	11	5/16	31
Pokok kelapa	11	7	12	6	1/7	14
Kancil	7	11	13	5	6/11	54
Badak air	14	4	18	0	0	0
Kura-kura	16	2	18	0	0	0
Total	96	66	129	33		
Improvement in Wrong Answers	66/(96+66)= 40.7%		33/(33+129)=20.4%			

Table 3: User Testing Result

Referring to Table 3, the total of false answer during the first set of questions is 66 over 162 questions. However, after the children had played with the modules, the number of false answer has reduced to 33 only. This illustrate that an average of 20.4% reduction in false answer has been achieved during the user testing.

From the observation during user testing session, the children know what to do although there are no questions given in the modules. It is proved that the children learn best using game method provided that the game are user friendly, age appropriate, interactive and has a wise content. From the user testing, it is identified that children aged 4 years old are not interested in using the 'Info' module. Thus, the author concludes that the 'Info' module may be suitable

V. CONCLUSION AND FUTURE WORKS

By developing the FunNature Android application, it can help to solve the problems such as inconvenient and not interactive reading materials and the need of parent-child quality time. It is believed that by using this app, children can pay more attention in learning about the nature. Parents and teachers can spend their time with the children by playing the games together. Hence, they can also explain more about a particular animal or plant as per displayed on the screen.

From the system testing with the teachers of Tadika Pintas Anak Soleh, it is identified that the application is able to capture the children interest and the content is appropriate according to the MOE preschool curriculum. Meanwhile according to user testing result, the children ability to recognise flora and fauna object improved by average of 20% after using the FunNature.

Further recommendation to improve the quality of this application is by conducting further research into other components of environment such as the weather, atmospheric level or the outer space. With this, children are able to explore a wider area of environment.

Besides, more modules should be created for the application to be more fun and interesting. Currently there are four modules in FunNature Android application available for the children to play. For future development, it is best if more modules can be added into the application. For example, a puzzle game that allows children to arrange pieces of a flora or fauna picture that will stimulate the children mental development. By playing puzzle, they will be able to exercise their mental image of a given object.

As discussed earlier, the limited functionalities of FunNature inhibit its usability as a medium for the teacher to measure the children progress. Therefore, in order for this Android application to be able to monitor children learning progress, it needs to have student account and login functionalities. Thus, teachers can view their student accounts and the games score of each student

REFERENCES

[1] Berk,L E. (2006). *Child Development*. Boston, Pearson Education, Inc

[2] CNet (2012). *Android reclaims 61 percent of all U.S. smartphone sales*. Retrieved 20 June 2012 from http://news.cnet.com/ 8301-1023_3-57429192-93/android-reclaims-61-percent-of-all-u.s-smartphone-sales/

[3] Clegg, D. & Barker, R. (2004). *Case Method Fast-Track: A RAD Approach*. Addison-Wesley.

[4] Erickson (2008). *The Children and Nature Network*. Retrieved 20 June 2012 from http://www.naeyc.org /files/yc/file/200801/BTJNatureErickson.pdf

[5] Gronli, T. M., Hansen, J., & Ghinea, G. (2010). *Android vs Windows Mobile vs Java ME*. A Comparative Study of Mobile Development Environments. Proceedings of the 3rd International Conference on Pervasive Technologies Related to Assistive Environments at ACM New York. New York : ACM New York.

[6]Hinds, J. & Sparks, P. (2007) . *Engaging with the natural environment: The role of affective connection and identity*. Journal of Environmental Psychology . 28: (2). Page 109-120

[7] Ma, X., & Bateson, D. J. (1999). *A multivariate analysis of the relationship between attitude toward science and attitude toward the environment*. The Journal of Environmental Education, 31(1), 27–32

[8] Ministry of Education (2010). *Kurikulum Standard Prasekolah Kebangsaan*. Retrieved 20 June 2012 from http://www.moe.gov.my/bpk/v2/index.php

[9] Newark-French, C. (2011). *Mobile Apps Put the Web in Their Rear-view Mirror*. Retrieved 29 October 2011, from http://blog.flurry.com/bid/63907/Mobile-Apps-Put-the-Web-in-Their-Rear-view-Mirror

[10] Olfman, S. et al.(2003). *All work and No Play*.Westport, Praeger Publishers.

[11] Pritchard, A. (2009). *Ways of Learning theories and learning styles in classroom*. New York: Routledge Taylor & Francis Group

[12] Saracho, N. & Spodek, B. (2003). *Contemporary Perspectives on Play in Early Childhood Education*. Information Age Publishing, Inc.

[13] Tilden, F. (1977). *Interpreting Our Heritage*. Chapel Hill, NC: University of North Carolina Press.

[14] Vangsnes et. al. (2011). *Computer games in pre-school settings: Didactical challenges when commercial educational computer games are implemented in kindergarten*. Computers & Education 58 (2012) 1138–1148

[15] Verenikina, I et al. (2003). *Child's Play: Computer Games, Theories of Play and Children's Development*. IFIP Working Group 3.5 Conference: Young Children and Learning Technologies, UWS Parramatta; Australian Computer Society, Inc.

[16] Verenikina, I et al. (2008).*The affordances of computer play in young children: A preliminary study*. University of Wollongong.

[17] Verenikina, I et al. (2006). *Computer Play, Young Children and the Development of Higher Order Thinking: Exploring the possibilities*. University of Wollongong.

[18] Fuks (2004). *Environmental Education and Nature Schools in Denmark*. Retrieved 15 June 2012 from http://diggy.ruc.dk/bitstream/1800/334/1/Environmental_education_and.pdf